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THE NATIONAL TELEPHONE MAGAZINE

JULY 15, 1941

TELEPHONE ENGINEER

Features: New Priority Rating for Telephone Industry . . . Two articles on Testing and Testing Equipment . . . Lesson V of Wire Chief's Training Course . . . News Highlights . . . North Dakota Convention Report . . . Line & Desk . . . Long Lines

MANAGEMENT ENGINEERING
MAINTENANCE

TE

TELEPHONE WIRE TYPIFIES THE

SUPERIOR QUALITY OF LEICH'S COMPLETE LINE OF MATERIALS

The heavy protective coating of galvanizing, the exceptional tensile strength, and the unusually high conductivity of Amertel telephone wire have made it the preferred conductor of hundreds of telephone companies. With Amertel, telephone men have constructed thousands of miles of the finest rural telephone lines the industry has ever known.

The Leich organization is proud to have been associated with this progress. It renews its pledge that every item in Leich's complete line of construction material shall be of the same high quality—and that every product supplied with Leich Service shall equal the excellent performance of Amertel.

LEICH SALES CORPORATION

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TELEPHONE ENGINEER
MANAGEMENT · ENGINEERING · MAINTENANCE

Vol. 45, No. 7 JULY, 1941

ACROSS THE Editor's Desk

It has been fun getting up this issue. For two months now we have been preparing several of the feature articles on testing equipment and methods. Our Technical Editor, B. C. Burden, has kept the postman so busy delivering material from Lincoln to Chicago that even he is looking for a nice quiet place where he might sit down and comb Ohmmeters and Test sets out of his hair. Our hair is getting so thin that we refuse to disturb anything on our own head for obvious reasons.

▼

However you can bet your boots that we'll be clean shaven on the morning of July 26. This is a "must" and is occasioned by the invite and several bulletins issued by the Midwest States Telephone Co., Rockford, Ill., to their annual picnic on that day. Lon Jester's secretary, Miss Eleanore Krakow, is the author of these clever bulletins and mentioned and pictured us as the "Smith Bros." (we hasten to add — "without beards"). Our camera will bring you the details in a succeeding issue. Lon's party is an annual affair and we treasure his invitation. The drumstick is our favorite picnic food, but we usually get the wing!

▼

We were pleased indeed to see the action of the OPM in giving the manufacturers serving the telephone industry a much better priority on materials. The manufacturers serving our industry deserve consideration from every operating company as they are doing a wonderful job on our Defense program.

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RAY W. SMITH, Editor—B. C. BURDEN, Technical Editor
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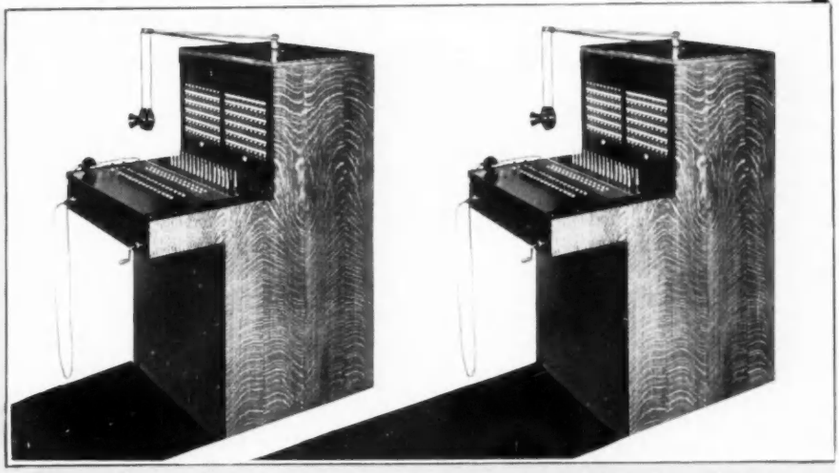
SERVING THE FIVE BILLION DOLLAR TELEPHONE INDUSTRY

Founded in 1909

Office of Publication, Pontiac, Illinois. Executive and Editorial Offices 7720 Sheridan Road, Chicago, Illinois. Phone Rogers Park 3040. RAY W. SMITH, Editor; ROY F. SMITH, Adv. Manager, DON C. SORENSEN, Sales Prom. Mgr. Subscrpitions: U. S., Cuba, Mexico, $1.50 Per Year; Canada, $2.00; In all Other Countries, $3.50. Single copies, U.S.A., 15 cents. All subscriptions should be sent DIRECT to 7720 Sheridan Rd. Entered as Second Class Matter at the Post Office at Pontiac, Ill., under the Act of March 3, 1879.

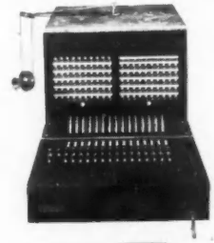
LIKE 2 PEAS IN A POD

(from Outward appearances)



But... LOOK AT ALL THE THINGS THIS

Welded steel framework forms the foundation of the type "K" PBX. Rigid and sturdy, this steel structure supports all the weight of the equipment and cabinet woodwork.



Operator's equipment is optional. It can be a suspended **NON-POSITIONAL** transmitter and lightweight headband receiver; a Bakelite Masterphone handset with **NON-POSITIONAL** transmitter; or a breastplate set with **NON-POSITIONAL** transmitter and lightweight headband receiver.

"Multi-Purpose" P.B.X. CAN DO FOR YOU!

You can install this PBX in factories, schools, hospitals, offices . . . *anywhere* . . . and give each subscriber *exactly* the kind of service wanted. You can connect it to a common battery manual or a dial main exchange, or to both! With a simple trunk adaptor at the central office, you can even connect THIS PBX to a magneto main exchange! The type "K" provides through-battery feed on jack-ended trunks! This means standard double-lamp supervision at the main exchange. The jack-ended trunks eliminate changing cords on outgoing calls, thus doing away with the "bang" in the ear characteristic of the old style plug-ended PBX switchboards. What's more, this highly versatile board is carried in stock, partially equipped, so you can get delivery in a fraction of the time required for a custom-built board. With prompt delivery like this, you can satisfy your subscribers by a quick installation and start collecting your revenue in short order. Here's your chance to standardize on equipment, on operating methods, on operator's instructions and on maintenance and routine practices. Write for Bulletin 142.

Kellogg Cordless PBX's Give You Unusual Flexibility, Too

Like the type "K", Kellogg Cordless PBX's also operate wherever you put them . . . whether in a common battery manual or dial area. With a simple adapter at the central office, they will even connect to a magneto exchange. Write for Bulletin 141.

TYPE "K"

PBX

KELLOGG

SWITCHBOARD & SUPPLY COMPANY—CHICAGO

TUNGAR BULBS
HELP YOU SAVE MONEY

The long operating life of Tungar Bulbs can help you cut down bulb replacement costs.

Get more out of the money you spend for battery charger bulbs by buying high quality G-E Tungar Bulbs. You may pay a bit more, but you save in the long run.

Say "G-E Tungar Bulbs" when you're buying and get those extra hours of operating life which mean dollar savings.

GENERAL ELECTRIC

ACCURATE TOLL TIMING-- to the SECOND!

Different central office set-ups demand different duties from the Calculagraph. Thus the Calculagraph Company offers three different Calculagraph models. You should find among these just the right one for your particular toll timing problem.

Model 33

MODEL NO. 33

This compact model (7½" by 3⅜") weighs only 8 pounds—operates on regulated current. Operator can easily determine the end of the initial period by a glance at the sweep second hand.

Electric Model No. 30

Prints elapsed time to the second. Choice of 12 or 24 hour time of day imprint. Same electrical characteristics as Model 33. Fits same switchboard space as No. 6.

Spring-Drive Model No. 6

Prints elapsed time in minutes and quarter minutes with 5 second indication. 8-day spring-drive, jeweled movement. Ideal where regulated A.C. current is not available or current is unreliable.

Model No. 6

Write for bulletins.

CALCULAGRAPH CO.
308 SUSSEX STREET HARRISON, N. J.

CALCULAGRAPH
Accurate Toll Timing to the Second!

Both Necessary for DEFENSE

SUPPLY LINES MUST BE KEPT INTACT

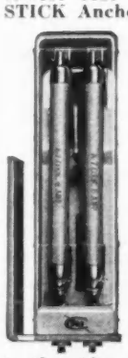
With all Industry working at top speed to meet the demands of National Defense, the telephone assumes an even more important place than ever. Telephone service must be prompt, efficient, and *unfailing*. Good supplies are essential if this is to be done.

Purchase your supplies from Stromberg-Carlson. They are of the high quality always associated with the name.

Stromberg-Carlson Telephone Mfg. Co., Factory and General Offices: 100 Carlson Rd. Rochester, N. Y. Branch Offices: Chicago, Kansas City, San Francisco, Toronto

EVERSTICK Expanding Anchors

Made of Certified Malleable Iron. Available in several types of 2, 3, and 4-way anchors. For tight, tenacious, safe guy anchoring, for holding power to stand up under all conditions, for lowest cost installation, the EVERSTICK Anchor is supreme.



COOK Type "O" Sub-Station Protectors

Are single circuit protectors made for both indoor and outdoor use. Body of arrester is porcelain. Fuse and Lightning Arrester Clips are of phosphor bronze. Lightning Arresters are Two True Gap Dischargers, and two flat carbons mounted on a copper ground strip are standard. The non-corrosive Everdur metal hood fits tightly to the sides and bottom of the porcelain. The hood is grounded through a strong Everdur hood guide. Made for various types and lengths of fuses.

NICOPRESS Sleeves and Splices

When you make splices with Nicopress Tools, you have joints of maximum strength —stronger than the wire itself. Once the Nicopress sleeves are pressed onto the conductors, you have joints that are as tight as a weld.

NO. 6 COLUMBIA GRAY LABEL DRY CELLS

With Fahnestock Connections

This dry cell is especially designed for telephone work and light drain service — 2 or 3 for a standard magneto telephone. Voltage: 1½; Diameter: 2½ in.; Height: 6 in. Standard package: 25; Shipping Weight: 57 lbs.

HABIRSHAW No. 17 BRONZE DROP WIRE

The conductor is a special high tensile strength alloy. It is insulated with a rubber compound of strong mechanical and high electrical characteristics, designed to resist oxidation caused by exposure. To further prolong the life of this rubber insulation, a closely woven cotton braid of highest quality double ply cotton yarn is used. This braid is impregnated with an asphalt saturator that thoroughly penetrates every fibre of the cotton and is finished with a special pitch compound to seal out the destructive agents, moisture and air.

CRAPO HTL-85 HIGH TENSILE TELEPHONE LINE WIRE

(CRAPO GALVANIZED)

Telephone companies can now lower construction cost, reduce maintenance expense and improve service by using this low resistance line wire for long-span rural lines. It makes possible spans of 225′ in heavy, 325′ in medium, and 375′ in light loading districts and provides stronger, safer spans on existing pole structures. Its superior transmission qualities contribute to improved service and make for greater customer satisfaction. Available in size numbers: 9, 10, 12, and 14 B.W.G.

NO. 1000 RELIABLE PROTECTORS

Consists of two P495 sawtooth discharge blocks, two P197 carbons and two No. 55 fuses. Length, 9 in.; Width, 3½ in.; Depth, 2½ in. Weight: 1½ lbs.

Stromberg-Carlson

A New Story to Tell

National Defense has a far-reaching effect on the whole country. The advertisement reproduced here appears in national magazines during July. It reflects the spirit of the day as it applies to the telephone companies of our nation. Advertising like this should help to foster a better understanding of the problems of the whole telephone industry, in these busy times.

More than a hundred new cities in the U.S.!

EVERY big military training camp is a city in itself. Like any city, it needs telephones.

But an ordinary city grows gradually over the years—and its telephone system grows with it. A *military* city may be built in a few months—often far from other towns. Here a telephone system must be set up *fast*—and linked with every other national nerve center by Long Distance lines.

It's a big job—made more so by the fact that some six hundred other expanding army and navy establishments — forts, flying fields, supply depots, arsenals, shipyards, etc.—also need hurry-up telephone facilities.

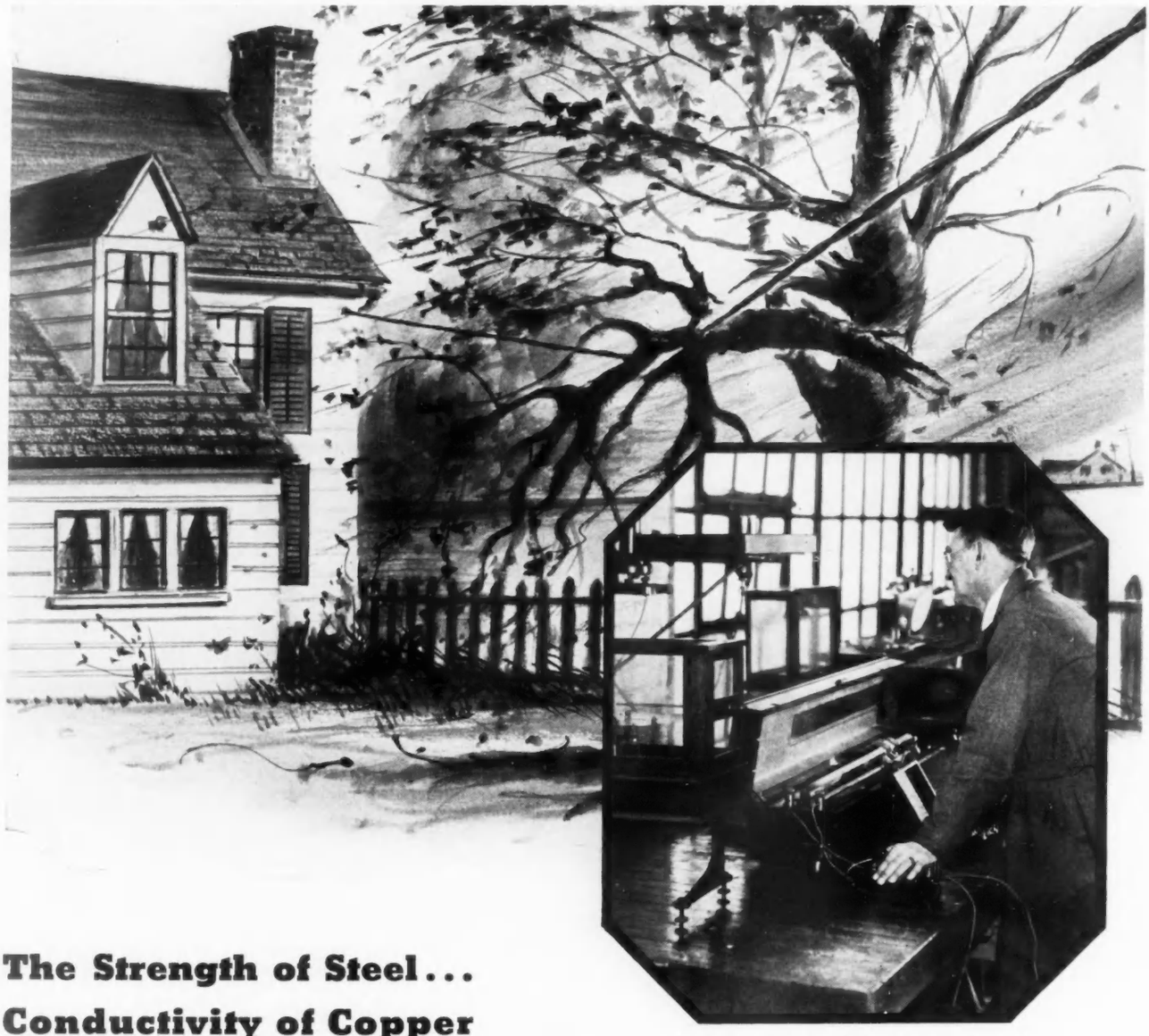
The Bell System is doing its best to meet these urgent defense needs — and at the same time satisfy the great and growing civilian demand for day-to-day telephone service.

Long Distance
helps unite the nation

"THE TELEPHONE HOUR" is broadcast every Monday. (N. B. C. Red Network, 8 P.M., Eastern Daylight Saving Time.)

AN ADVERTISEMENT OF THE BELL TELEPHONE SYSTEM

MONOTYPE... THE DROP WIRE THAT CAN "TAKE IT"



Testing conductivity of drop wire conductor in the Test Department of a General Cable plant.

The Strength of Steel... Conductivity of Copper

Monotype, with its Copper-weld conductor, combines the strength of steel and conductivity of copper... to save you service expense.

MONOTYPE DROP WIRE

MANUFACTURED BY

GENERAL CABLE CORPORATION

DISTRIBUTED BY

AMERICAN AUTOMATIC ELECTRIC SALES COMPANY

1033 WEST VAN BUREN STREET • CHICAGO, ILLINOIS

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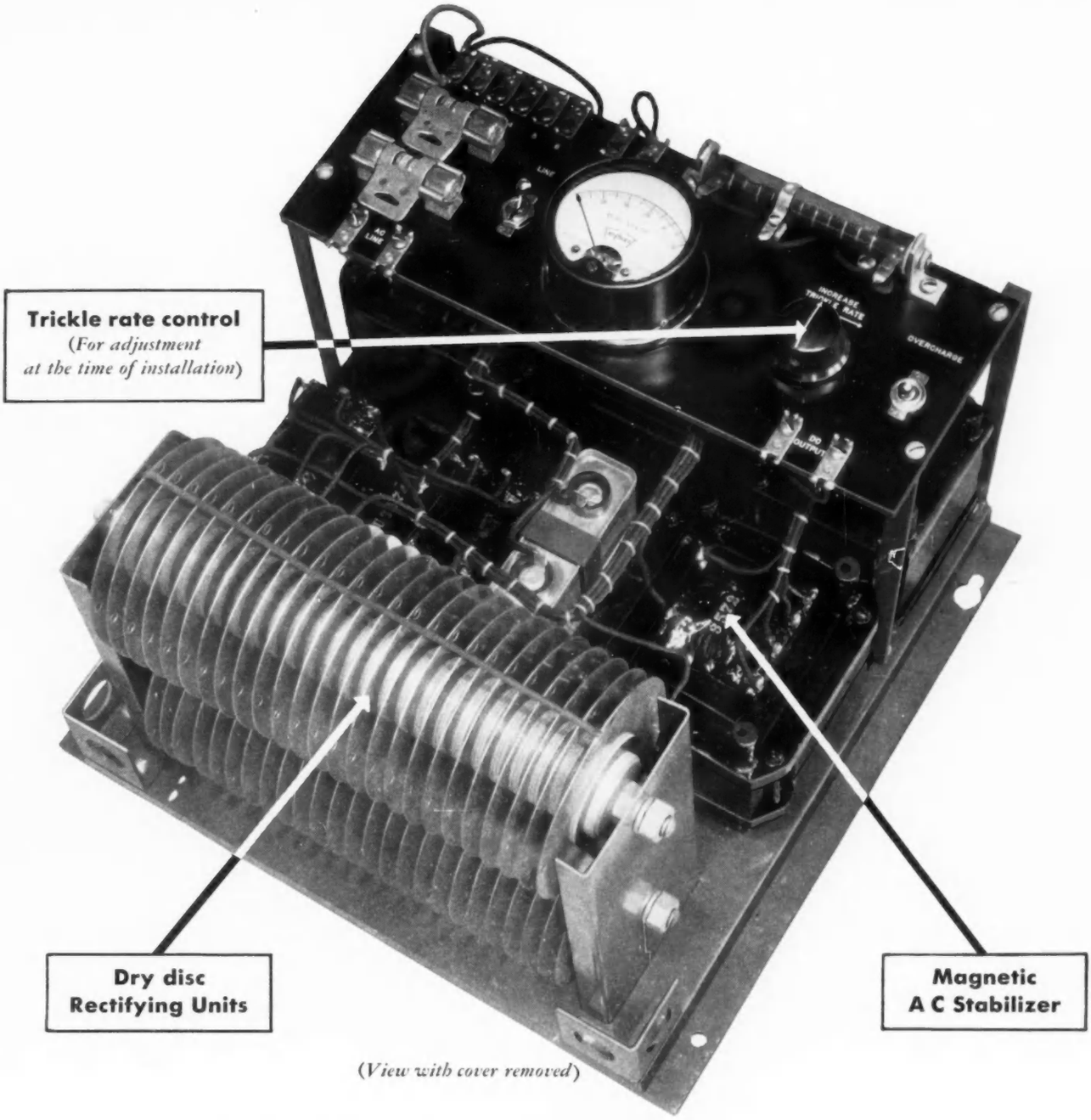


(*View with cover removed*)

RAYTHEON RECTICHARGERS OPERATE UNATTENDED

PLUG 'em in — go away and forget 'em. What a pleasure it is to use a battery charger without moving or expendable parts. Nothing that requires frequent adjustment.

The ingenious design of the Raytheon RectiChargeR enables its output to follow the load and assume full responsibility for keeping your storage batteries fully charged, neither burning them up by overcharging nor starving them by undercharging.

Battery life may be increased as much as 40%.

Operating difficulties such as under and over voltage, short lamp life, frying transmitters and sticking relays are automatically eliminated.

RAYTHEON MANUFACTURING COMPANY
190 WILLOW STREET, WALTHAM, MASS.

Please send your illustrated literature on Raytheon RectiChargeRs.

Name.....

Address.....

.....

7TE

Tops for long-span, low-cost construction . . . more dependable where ice and wind load is a factor . . . *Crapo* galvanized line wire meets every requirement for overhead lines. Bought "via GRAYBAR" it has double value, because of the added benefits of cooperative buying assistance and a one-call source of supply. It's easy to prove this to yourself . . . call GRAYBAR next time the need for line wire arises.

Crapo HTL-135 . . . Combines a degree of physical strength and low electrical resistance never before available in a ferrous wire . . . permitting spans from 200 to 500 feet. Regularly furnished in No. 12 B.W.G. in continuous lengths. Write GRAYBAR for 19-page booklet, No. 202, which contains such valuable information as engineering data, construction practices.

Crapo HTL-85 . . . A high-strength line wire for long spans, or for giving standard length spans extra strength to meet increased ice or wind loads. Available in sizes 9 to 14 B.W.G. Like HTL-135, it comes in continuous lengths with no splices or joints. Its transmission and signal qualities are excellent. Bulletin 201 will give you the complete story. Write GRAYBAR for your copy today.

Crapo Galvanized Steel Strand . . . Popular in the telephone field for many years. Available in all standard sizes and grades. Write GRAYBAR for full information.

Branches in over 80 Principal Cities.

GRAYBAR ELECTRIC COMPANY
Executive Offices:
Graybar Building, New York, N. Y.

GraybaR QUALITY — Distributed and guaranteed by GraybaR ELECTRIC COMPANY

25 YEARS AGO THIS MONTH

Taken from TELEPHONE ENGINEER files of July, 1916

W. R. Pierce, general manager of Alberta Government Telephones, Edmonton, Alberta, Canada, visited Chicago in the latter part of June, 1916 and dropped in to say "hello" to the staff of TELEPHONE ENGINEER.

▼

One of the exhibits at the convention of the National Electric Light Association, twenty-five years ago this month, that attracted much attention was a large drawing of the building of the Chicago Telephone Company grouped to make a telephone city. The drawing embraced the company's 47 office buildings and four other telephone structures. It was a manifestation of the size and importance of the telephone industry during 1916.

▼

The largest parade in the history of the United States was the preparedness parade held in Chicago during June of 1916. The directing officer, Captain Raymond Sheldon, kept in constant touch with the columns of marchers by means of telephone stations scattered along the line of march. There were eighteen stations and each station was in charge of two telephone company men who received orders from the directing commander and transmitted them to aids on horseback.

▼

The Board of Directors of the United States Independent Telephone Association held a meeting in Chicago on Monday, June 26, 1916. Those attending were Messrs. Adams, Allen, Beam, Casler, Critchfield, Edwards, Fisher, Fuller, Gary, Goodrich, Heller, MacKinnon, McCanne, McMeen, McVey, Parlett, Reber, Robinson, Tarte, Uhl, Vivian and Woods. The application of 65 companies were favorably acted upon and elected to membership in the association. This totaled the membership of the association at 600, which was the largest membership any Independent telephone association had ever had.

▼

District Manager James Northey of the Southern Bell Telephone Company, Charlotte, North Carolina was presented with a thirty year button for service June 1, 1916, which was accompanied by a letter from the Southern Bell officials complimenting him on the excellent service and the efficient work he had done.

Exide

The battery that helped to build America
. . . now helps to make her STRONG

THE same dependability in Exide Batteries that has made them so real a part of America's industrial progress now gives these batteries an even graver task.

In the nation's military forces—in the Army's mechanized divisions, in the air force, and in the Navy—Exides have been entrusted with functions in which no battery dares fail.

Behind these front lines of defense—in our mines and manufacturing plants, our farms, our railroads and communication systems, our fleets of buses and trucks, our electric generating plants, steamship lines, fishing fleets, and Diesel-powered construction equipment, even in our hospitals and public buildings—Exide Batteries are steadily, dependably serving the nation.

It is not by chance that Exides have been placed in so many key positions. For fifty-three years they have been proving how well they merit this confidence.

Most storage batteries look very much alike—outside. Inside, you find the differences that count. In an Exide Telephone Battery you find the reasons for the faithful battery dependability which, for forty-five years, has been helping the telephone companies to uphold their world-famous tradition of quick, clear, unfailing service.

Look behind an Exide Battery and you find a manufacturer and a service organization with policies designed to benefit the user by insuring the utmost in performance, and the longest, most dependable and economical battery service that human skill can provide.

These are the reasons why you can confidently entrust your own battery needs to Exide.

Exide
TELEPHONE BATTERIES

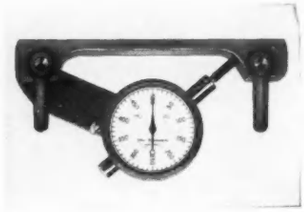
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

The Wide Acceptance Of

DILLON DYNAMOMETERS

Is Proof Of Their Outstanding

MERIT



MODEL A

DIMENSIONS: 7½" x 5¾" x 2⅜"

0 to 2,500 Lbs.	$ 75.50
0 to 3,500 Lbs.	80.50
0 to 5,000 Lbs.	85.50
0 to 7,500 Lbs.	91.00
0 to 10,000 Lbs.	97.50
0 to 12,500 Lbs.	107.50
0 to 15,000 Lbs.	117.50

DIAL DIAMETER: 5"
WEIGHT 4½ pounds

MODEL B

DIMENSIONS: 6" x 3¼" x 1"

0 to 500 Lbs.	$50.00
0 to 750 Lbs.	57.50
0 to 1,000 Lbs.	65.00

Both models include attachment shackles and carrying case.

DIAL DIAMETER: 2¼"
WEIGHT: 1½ pounds

WILL LAST A LIFETIME FOR A LIFE TIME OF *PERFECT* PERFORMANCE

When it comes to **accurately** measuring the tension applied to guy, cable or long span wire, DILLON Dynamometers have no equal. Of flawless design both inside and out, these rugged utility instruments fill a long existing need for a **light weight** tension indicator **at a reasonable price.** With DILLON Dynamometers as part of crew equipment, repair expenses occasioned by over-taut wires become a thing of the past. In use by leading Telephone Companies everywhere—they represent a vital link in the construction of flawless lines Today for American defense **Tomorrow!** Equip **your** crews with DILLON Dynamometers by ordering through your jobber or direct.

W. C. DILLON & COMPANY, INC.

5410 WEST HARRISON STREET - TELEPHONE COLUMBUS 5885 - CHICAGO, ILLINOIS

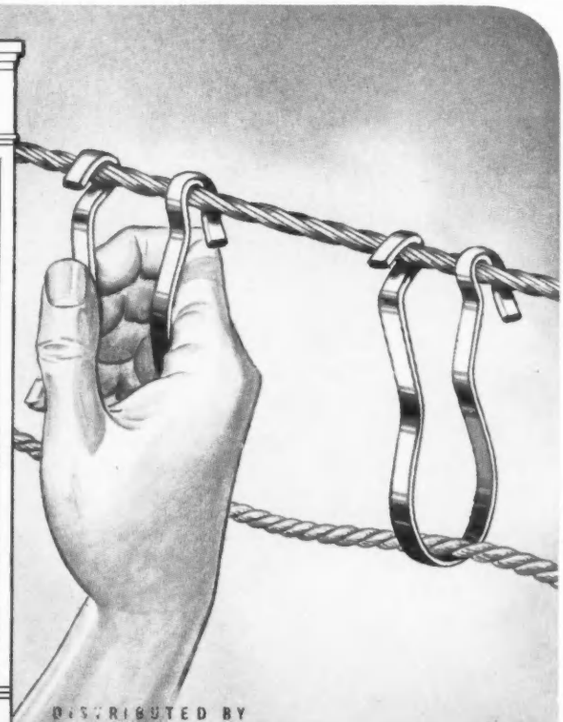
NO DELAY
The NATIONAL Way

No quicker way of ringing than with Nationals. And — thanks to "tension grip"—no jumping off, no slipping along messenger. No hooking together in lineman's pail — thanks to "Handy Five" cluster packaging.

Standardize on National Cable Rings.

Made by

THE NATIONAL TELEPHONE SUPPLY CO.



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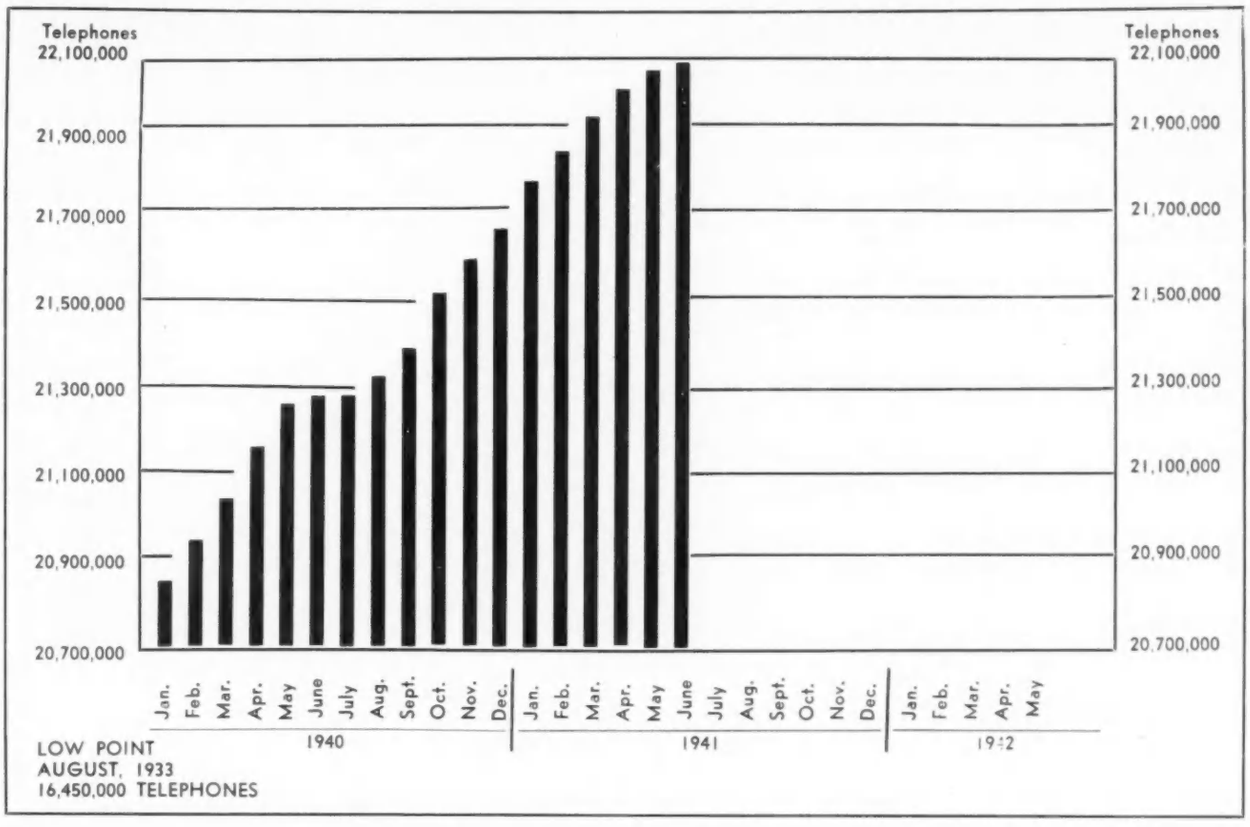


Telephone Engineer

HANDBOOK TABLES

Subject: *The Decibel*—GENERAL

By B. C. Burden

File—Transmission Data
Date—July 15, 1941

The ability of a telephone circuit to carry telephone conversation is usually rated in terms of the decibel, (db). The decibel is unique in that it is a unit of ratio, i.e., it expresses the ratio between two amounts of power. For example, a 3 db line loss means that the input power suffers a 50% reduction in passing thru the line. It should be particularly noted that the db has no quantitative significance unless referred to some **zero reference level.** To illustrate, if we say that the telephone voice level is plus 3db above a zero reference level of .006 watts, then the decibel does take on quantitative significance and in this case represents a power of .006 x 2 or .012 watts. By definition the number of decibels loss in any line is equal to

$$db = 10 \log \frac{P_{out}}{P_{in}}$$

That is, to determine the loss in decibels multiply ten times the logarithm of the output power divided by the input power.

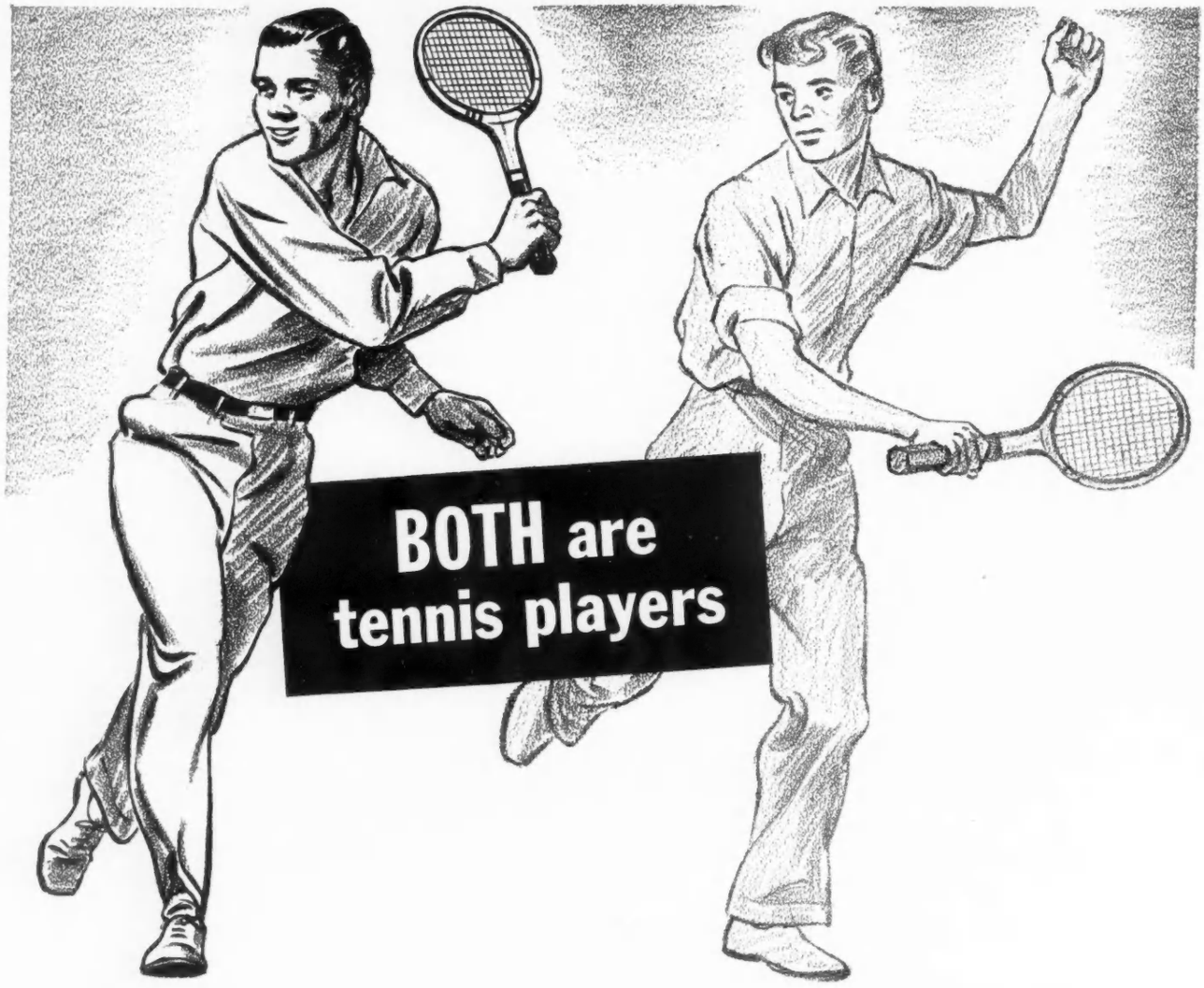
USE OF TABLES

In practical telephone testing work, we can use tables of decibels vs. power and voltage ratios and avoid the use of complicated equations. These tables are particularly useful when making transmission measurements. For example, if a 1000 cycle voltage source is fed into a line and the input and output voltages measured, the ratio of these voltages can be converted into decibels by the use of the following table. After converting the loss of a line into decibels we can then check this measured value against other tables which are available and which show the normal losses in decibels to be expected from various types of line and cable circuits.

Note—To use table locate voltage or power ratio in right hand columns. For example if input voltage was 9 volts and output voltage 3.0 volts. The loss ratio would be $\frac{3}{9.0}$ divided by 9 or 0.33. Under loss ratio we find 0.316

which equals 10 db—hence we know our loss is slightly less than 10 db.

Decibels for Voltage Ratios	Power Ratios	Gain Ratio	Loss Ratio
1	0.5	1.122	0.891
2	1.0	1.259	0.794
3	1.5	1.413	0.708
4	2.0	1.585	0.631
5	2.5	1.778	0.562
6	3.0	1.995	0.501
7	3.5	2.24	0.447
8	4.0	2.51	0.398
9	4.5	2.82	0.355
10	5.0	3.16	0.316
11	5.5	3.55	0.282
12	6.0	3.98	0.251
13	6.5	4.47	0.224
14	7.0	5.01	0.200
15	7.5	5.62	0.178
16	8.0	6.31	0.153
17	8.5	7.08	0.141
18	9.0	7.94	0.126
19	9.5	8.91	0.112
20	10.0	10.0	0.100
21	10.5	11.2	0.0891
22	11.0	12.6	0.0794
23	11.5	14.1	0.0703
24	12.0	15.8	0.0631
25	12.5	17.8	0.0562
26	13.0	20.0	0.0501
27	13.5	22.4	0.0447
28	14.0	25.1	0.0398
29	14.5	28.2	0.0355
30	15.0	31.6	0.0316



BOTH are tennis players

Developed and constantly improved *in the world's largest dry battery laboratory, "Eveready" "Columbia" "Gray Label" Long Life telephone cells provide maximum efficiency at rock-bottom economy. It pays to specify them. Available at leading telephone supply distributors.*

...but ONE is a CHAMPION!

Performance makes the difference!

Stamina and efficiency set the *champion* tennis player apart from others. The same is true of telephone dry cells.

"Eveready" "Columbia" "Gray Label" Long Life telephone cells are made with painstaking precision . . . made for the one purpose of delivering *longer* service life at higher sustained voltage.

They have the "extra stamina" that means *better* transmission standards . . . increased subscriber satisfaction. That's why more independent telephone companies use "Eveready" "Columbia" "Gray Label" Long Life telephone cells than any other brand!

CHAMPION FOR THREE REASONS

- ★ **Longer Life**
- ★ **Sustained Voltage**
- ★ **Uniform Quality**

NATIONAL CARBON COMPANY, INC.
General Offices: New York, N. Y.
Branches: Chicago and San Francisco
Unit of Union Carbide and Carbon Corporation
UCC

The words "Eveready", "Columbia" and "Gray Label" are trade-marks of National Carbon Company, Inc.

Highlights of the Communications News

Important Communications developments of the past month, briefed for busy readers

by

ROLAND C. DAVIES
Editor, Telecommunications Reports

THERE is no change in the position and policy of the governmental defense authorities, as represented in the form of the Defense Communications Board, that even in event of American participation in the war the taking over of the nation's communications system by the government is not contemplated nor would be done under any emergency situation. The telephone industry, in particular, is regarded as having most competent management and personnel and Army and Navy authorities feel it would be a most foolish and wasteful move to institute government ownership and operation.

But, of course, in the case of any areas of the United States which would be under actual war attack conditions or subject to enemy air raids, the Army would naturally institute stringent control and supervision over telephone facilities during such an emergency period. Under these conditions such a region would be under martial law and "all bets would be off" as to normal operations of not only communications but all other forms of civilian activity.

This reaffirmation of the policy of the defense authorities in regard to communications was ascertained through interviews by the Washington correspondent of TELEPHONE ENGINEER with the leadership of the DCB since the Defense Communications Board has now rounded out its first six months of active work with its advisory and technical committees in the formulation of plans for the operation and functioning of the telephone industry and other branches of communications in national defense and in event of the actual entrance of the United States into the war. DCB Chairman James Lawrence Fly who is Chairman of the FCC declared that the DCB committees, "composed of the best group of experts in communications in the country", had evolved very constructive plans and had given the Board most encouraging and helpful cooperation.

Work of DCB

THE work of the DCB has been conducted with the greatest secrecy because its work involves the communications activities in war-time. But DCB Chairman Fly revealed several phases of these defense communications preparations of important interest to the telephone industry, both Bell System and Independents. First has been the establishment of a **message priorities** plan under which telephone calls and messages of military importance will be granted immediate precedence. In the case of the utilization of the air raid warning services, which have been established by the Army and have been tested in a number of sections of the country using the Bell System and Independent telephone facilities, the civilian population would be warned not to use the telephone except for absolute necessity purposes at such times and the telephone facilities would be cleared to handle air raid reports on a priority basis over civilian communications. As has been previously described, the air raid warning service has been planned by the Army to comprise the spotting of civilian air raid observers at strategic points in a city and its vicinity or throughout a state, and the latter telephone in reports on "enemy" airplanes to filter exchanges which evaluate their information and dispatch it to the Army Air Defense Headquarters so that interceptor airplanes can be dispatched to attack the bombers.

Interconnecting Systems

ANOTHER phase of the DCB planning has been the study of greater interconnection of telephone systems throughout the country. DCB Chairman Fly pointed out that for most of the United States the telephone facilities are adequate and excellent from a defense standpoint, but that there were some situations in sparsely settled regions, particularly in the West, where there was need of greater interconnection. He cited that the interconnection problem applied in these Western areas particularly to the Independents and, while an Independent may have one connection with the long distance network, it might be desirable to have an alternative connecting link with the toll system. He noted that the telephone systems, operated by oil companies for the functioning of their pipelines, were useful with regard to this interconnection question. He added that there may arise the necessity of construction of more interconnecting links. This work, DCB Chairman Fly said, might be done by the Bell System or Independents, according to the territory where such a need arises, or by the Army Signal Corps. Who should do such work has not yet been a matter of concern Mr. Fly declared, because the telephone industry has demonstrated such excellent cooperation that tasks like this are not viewed with any anxiety.

Chairman Fly disclosed that at the request of the DCB in the international communications field, particularly, each company appointed a liaison at every major operating office to facilitate the interchange of traffic, interconnection of

Officers of the Oregon Independent Telephone Ass'n. left to right, Leslie A. Gritten, Secretary-Treasurer; Geo. Muhle, Lowell Brown, W. A. Schaefer, Ethel A. Bauman, T. J. Wells, Directors; and D. O. Hood, Vice-President. Note: President Chas. E. Wells was absent because of illness.

facilities and other means of coordination in the event of a emergency. This plan also is being worked out in regard to the domestic telephone and telegraph services in strategic areas of the country.

Auxiliary Power Sources

THE problem of auxiliary power sources in event of the bombing or failure of the main electric power company supply in a community also has been carefully studied by the DCB. The Board has prepared a manual dealing with auxiliary power supplies, outlining the various possible means of insuring adequate power in the case of an emergency. The Army and Navy authorities, however, are well aware of the widespread and careful planning and location of emergency gasoline and Diesel oil power generators which have been placed by the Bell System and leading Independents in their major central offices in important cities of the nation.

Maps & Charts

THE Army Signal Corps has also performed a notable task in the assembling of every available map and chart showing the communications facilities of the entire United States. This data was secured by Major General Joseph O. Mauborgne, Chief Signal Officer of the Army, from the American Telephone and Telepraph Co., its Bell System Associated Companies, Western Union, Postal Telegraph and the United States Independent Telephone Association. The USITA prepared extensive data for the Signal Corps on its 12,000 exchanges scattered throughout the country. General Mauborgne planned this compilation with the objective of creating a centralized clearing house on communications facilities for all branches of the Army, and under a new procedure officers of Army units will forward their desires on data concerning communications facilities to General Mauborgne who then will supply them with the material. This will relieve the telephone companies of preparing separate charts and maps for the Army units in different sections of the country, as had been done under the previous procedure when the various Corps areas and other field divisions of the Army could request the telephone companies in their immediate vicinity to supply such information which sometimes constituted a considerable burden and expense.

Army "Thanks" Independents!

Appreciation of the "fine cooperation" which the Army is receiving from the United States Independent Telephone Association and its member companies and the high calibre of men which the telephone industry has contributed to the Army's communication forces was expressed by Major General Joseph O. Mauborgne, Chief Signal Officer of the Army, in a recent letter to Carl D. Brorein, USITA President.

General Mauborgne cited that there may arise the necessity for more Reserve Officers from the Independent industry and the installation of telephone facilities in new military camps and stations because of the unlimited emergency, declared by President Roosevelt. General Mauborgne declared that "I know the Army can depend on you to continue to do your full share."

The text of the letter which was dated June 28 follows:

"I should like to take the opportunity afforded by the meeting of your Executive Committee to tell you that the Army is grateful for the fine cooperation it is receiving from the United States Independent Telephone Association and its members.

"As Chief Signal Officer, I am mindful of the generous and timely response of the independent telephone companies to the service needs of the military establishments located in their territories, and of the high calibre of the men which your industry has contributed to the Army's communication forces.

"More Reserve officers from your member companies for active duty in connection with the Defense Program, and the installation of telephone facilities in the new military camps and stations that may be established in the territories served by the independent companies, are possibilities which may grow out of the unlimited emergency which the President has declared and I know that the Army can depend on you to continue to do your full share.

Sincerely yours,
J. O. Mauborgne,
Major General
Chief Signal Officer of the Army."

Centralize Defense Work

ANOTHER interesting defense move recently was the appointment by President Roosevelt of Dr. Vannevar Bush, Chairman of the National Defense Research Committee and President of the Carnegie Institution, as Director of the National Defense Scientific Research and Development under the Office for Emergency Management to centralize all defense research work, both in the Army and Navy and by private industry, and to expedite the mobilization of the nation's scientific personnel and resources for the defense program. The National Defense Research Committee is to continue as an advisory body to Dr. Bush and to make recommendations for the governmental defense scientific development work. One of the members of the NDRC is Dr. Frank B. Jewett, Vice President of the American Telephone and Telegraph Co. and Chairman of the Bell Telephone Laboratories, who is a member of the Committee by virtue of his position as President of the National Academy of Sciences.

New Tax Bill

THE telephone industry and its subscribers, besides the regular corporation income surtax and the excess profits tax, will make a substantial contribution to the government defense expenditure needs under the new tax bill which has just been introduced by the House Ways and Means Committee in the House as the first step towards Congressional enactment of this revenue measure. The total estimated revenue from the two excise taxes, affecting the telephone industry, amounts to $71,200,000.

The excise levy on communications messages including long distance interstate telephone calls, is started at a base of 25 cents—which represents an upward revision from the original Treasury Department proposal for an exempted base of 15 cents. This tax is also levied on such services as news tickers, stock quotations, TWX etc., but so far the House Committee has not formulated a tax rate for leased wire service on a rental basis, although it is expected that this rate will be about 10%. The levy on long distance telephone messages will be 5 cents from 25 cents to 49 cents; 10c, from 50c to 99c; 15c, from $1 to $1.49; 20c, from $1.50 to $1.99; 25c, from $2. to $2.49 and from $2.50 upwards 5c for each additional 50c or fraction thereof.

The other excise levy will be 5 per cent on telephone bills, excluding the charges for interstate toll calls. This levy which will have an estimated yield of $43,600,000 is a matter of concern for the Independent telephone industry because of

(Please turn to page 28)

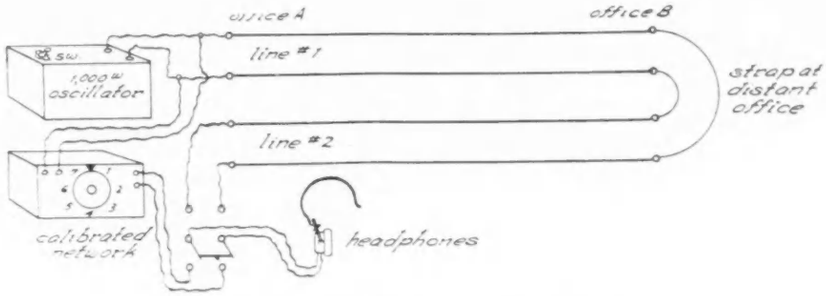


Fig. 2—Circuit of Ear Balance Transmission Set.

Fig. 1—Typical Power Level Meter. (Courtesy Weston Electrical Instrument Corp.)

MODERN METHOD OF TRANSMISSION TESTING

By B. C. BURDEN

Transmission Engineer,
Lincoln Tel. & Tel. Co.

TECHNICAL EDITOR

General

TRANSMISSION tests are necessary to determine the overall talking efficiency of telephone circuits. Although simple electrical tests will give a measurement of the ability of a circuit to carry voice currents, it will fail to detect certain inherent losses that may be the cause of poor transmission. For example, the ohm meter is useful in locating bad splices which are a source of poor transmission, but would not be useful in attempting to locate transmission trouble due to an inefficient toll circuit repeating coil.

The modern method of making transmission tests consists in impressing a 1000 cycle voltage source on the circuit to be tested and measuring both the impressed and output voltage. The ratio of the input to the output voltage gives a quantitative rating of the circuit loss.

Reason for Using 1000 Cycle Current

THE range in voice frequencies necessary for intelligible telephone communication extends from about 200 up to 3000 cycles. Theoretically to get a precise determination of the transmission efficiency of a telephone circuit, it would be necessary to make a large number of measurements at frequencies extending from 200 to 3000 cycles. Practically it has been found that an audio frequency measurement made at the single frequency of 1000 cycles will give a good measurement of the transmission ability of a circuit and obviously it is much easier to make a single frequency measurement than to make measurements at a number of different frequencies. Hence, all ordinary transmission measurements are generally made with a tone source of 1000 cycles. Transmission measurements over a wide range (100 to 5000 cycles) are required in connection with high fidelity toll circuits used in the transmission of chain broadcast programs.

Ear Balance Test Methods

BEFORE the copper oxide type of A. C. Voltmeter was made available transmission testing was usually done by the ear balance method. Many of these early ear balance measuring instruments are still in use. In this method a 1000 cycle tone is transmitted over the circuit to be tested and "looped back" to the tester on another circuit preferably a duplicate of the first. By means of a key switching arrangement the tester listens over an ordinary telephone receiver and compares the volume of the tone received through the line under test to that received through an adjustable resistance network (artificial line). The network is then adjusted so that the same apparent volume is heard under the two listening conditions. The circuit of the ear balance set is shown in Fig 2. The loss of the line under test is equal to the network dial setting (in decibels) less the loss in the circuit used to loop the circuit under test back to the testing point. If both the circuit under test and the loop back circuit are of the same length and type, then the loss of the testing circuit will be equal to one half of the network setting. Where there are three or more circuits available between offices then the loss of each individual circuit can be determined by the **triangulation formula.** To find the individual loss of each of three circuits, when it is necessary to test them on a "loop back basis," use the following equation. (See Fig. 3).

$$\text{Loss Circuit A} = \frac{(A+B)+(A+C)+(B+C)-(B+C)}{2}$$

$$\text{Loss circuit B} = (A+B)-A$$

$$\text{Loss circuit C} = (A+C)-A$$

The ear balance method, although dependent on the ear for judging the conditions of balance, was surprisingly accurate and competent testers would seldom be more than 1 db apart on the same measurement. The 1000 cycle oscillators were used to provide a source of tone for either of the **tuned reed** or **vacuum tube type.**

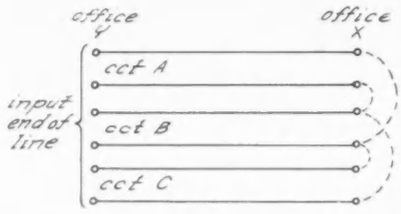


Fig. 3 — Triangulation formula useful for Loop Back Measurements.

Power Level Testing Method

THE ear balance method of transmission testing has been largely replaced by the power level method of measurement. A typical power level meter is illustrated in Fig. 1.

This method involves the use of a fixed 1000 cycle tone which is impressed on the input end of the line or apparatus to be measured, and a copper oxide type A. C voltmeter or power level indicator at both the input and output ends of the circuit to record the loss (or gain) in power that the 1000 cycle tone incurs in passing through the circuit. The required units for this method of measurement are shown in Fig. 4. The transmission loss of the circuit under test is equal to the algebraic sum of the two input and output readings which are read directly from the power level meter dial which is calibrated in decibels, or where an ordinary A. C. voltmeter is used the loss is computed by the relationship:

$$db = 20 \log \frac{\text{output voltage}}{\text{input voltage}}$$

By the use of conversion tables, volts can be converted to decibels without the necessity of using the above formula.

The power level method of measurements permits tests to be made without the necessity of looping back to the sending end of the line.

The copper oxide meter makes possible this method of testing as it is able to measure the 1000 cycle frequency without appreciable error and the meter has sufficient sensitivity to give readable deflections on both toll and exchange lines with reasonable input powers.

The ordinary soft iron vane type A. C. voltmeters are not suitable for transmission measurements as they are relatively insensitive.

Essential Difference Between Power Level Meters and A.C. Voltmeters

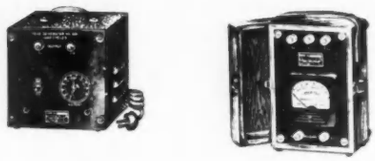
THE essential difference between the power level meter and the copper oxide A. C. voltmeter should be fully appreciated. The chief difference is in use and calibration as the power level meter is nothing more or less than an A. C. voltmeter. As has been explained the decibel has no real quantitative significance unless tied down to **a zero reference level.** In order to calibrate an A. C. voltmeter in decibels, it is therefore necessary to first establish the zero reference level. Instrument manufacturers use different levels—some using one milliwatt at 600 ohms and others six milliwatts at 600 ohms as the reference level. The zero reference level is like the bench mark of a surveyor in its application.

Having established a zero reference level, all measurements can be referred to this zero level, thus enabling the use of the db on a direct reading basis. For example, if we had a wattmeter with which we could measure the input and output power on a line under test, we could refer each reading back to zero level power and thus determine the relative level of any measurements taken. The difference between input and output levels expressed in dbs would be the transmission loss of the circuit under test. The wattmeter could be calibrated to show decibels instead of watts. To illustrate, assume that our zero level is one milliwatt (.001 watt), then the wattmeter dial would show 0 db at .001 watt, plus 3 db at .002 watt, -3 db at .0005 watts, etc. Note—3 db equals a power gain or loss of approximately 2.0.

Voltage Used Instead of Watts

Wattmeters suitable for measuring the low powers used in telephone testing are not available, hence, it is customary to measure power in terms of the voltage impressed across a known impedance, i.e., **power in watts is equal to voltage squared divided by impedance;** $P = \frac{E^2}{Z}$

In other words, **we can use a voltmeter to measure watts provided we know the impedance across which the reading is taken.** From this it can be seen that if we are to use a voltmeter as a power level indicator calibrated in decibels, our calibration must be based on both a fixed zero reference level and a fixed impedance.



1000 cycle oscillator — power level meter

Fig. 4—Required Units for Modern Method of Transmission Testing. (Courtesy Shallcross Mfg. Co.)

It is customary to use 600 ohms as the fixed impedance, and either one or six milliwatts as the zero reference level. Assuming that our zero reference level is .001 watts at 600 ohms, then 0.775 volts on the dial of our power level meter (which is nothing but an A. C. voltmeter) will correspond to zero decibels, 1.55 volts to plus 3 db, 0.387 volts to -3db, etc. Table No. 1 shows the complete calibration of an A. C. voltmeter on the basis of .001 watts and 600 ohms.

It is important that the impedance across which the instrument is placed be 600 ohms if the readings are to be accurate.

Simple Measuring Apparatus

A complete transmission testing setup for the small and medium sized exchange requires the following items:

(Please turn to page 35)

Voltmeter Reading (volts)	Level in db
2.45	+10
2.18	+9
1.94	+8
1.74	+7
1.55	+6
1.38	+5
1.23	+4
1.09	+3
0.97	+2
0.869	+1
0.7746	0
0.690	—1
0.615	—2
0.548	—3
0.489	—4
0.435	—5
0.388	—6
0.346	—7
0.308	—8
.275	—9
.45	—10

Table No. 1—Conversion of volts to decibels —Reference level 600 ohms and 1.00 milliwatts.

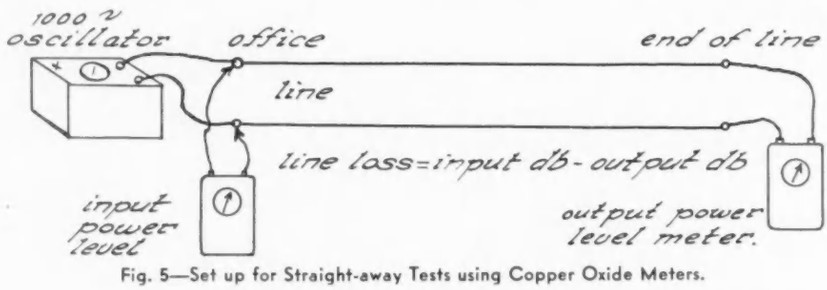


Fig. 5—Set up for Straight-away Tests using Copper Oxide Meters.

Telephone Industry Given New Priority Status

By OPM

THe most difficult task of the telephone industry in the furnishing of apparatus and equipment for its rapidly increasing service, both in connection with Army and Navy and defense industry establishments and for its civilian subscribers, was aided to a certain degree by the Washington defense priorities authorities when the telephone industry was classed on a priority status above other civilian industries for the allocation of strategic raw materials which go into the production of telephone equipment.

This assistance was ordered by both Director of Priorities E. R. Stettinius, Jr., of the Office of Production Management (OPM) and by Leon Henderson, chief of the Office of Price Administration and Civilian Supply (OPASC). Conferences with Mr. Stettinus and Mr. Henderson were to be held on this program of priority status by the United States Independent Telephone Association Defense Coordinating Committee, headed by Carl D. Brorein, USITA President and President of the Peninsular Telephone Co. of Tampa, Fla.; E. C. Blomeyer, Vice President of Theodore Gary and Company; John H. Agee, Vice President and General Manager of the Lincoln Nebraska Telephone and Telegraph Co.; J. F. O'Connell, President of the Commonwealth Telephone Co.; and Col. Gustav Hirsch, leading telephone consulting engineer, of Columbus, Ohio.

The program for a priority status on raw materials for repair and maintenance equipment was promulgated by OPM and OPACS to allow uninterrupted operation of the telephone industry, together with the telegraph and radio communications services and 23 other industries which were declared to be essential to the "public welfare and maintenance of civilian supplies." The recommendations for this priority status first were issued by OPACS Director Henderson and then OPM Priorities Director Stettinius 10 days later promulgated the order legalizing this status and setting it into effect. It was stated by the OPACS and OPM that the materials and equipment for the maintenance and repair for the telephone industry shall be allocated "prior to all other civilian requirements and prior to defense requirements consistent with the defense program as determined by OPM."

The definitions of the Henderson recomendations constituted the most important point in this program's announced and read as follows: "The term "maintenance" means the upkeep of property and equipment and the term 'repair' means the restoration of property and equipment to a sound state after wear and tear, damage, destruction of parts or the like. These terms include replacement of parts which have been worn out, damaged or destroyed, but do not include replacement when the new part or parts represent a change over in model, the introduction of a superior type equipment to replace usable equipment of an older or inferior type or design, or a substitution more extensive than that which is necessary to replace the part or parts that are worn out, damaged or destroyed". This phraseology was interpreted to mean that the maintenance and repair activities could not effect changes in telephone service for civilian operations with more modern or improved equipment than was existing at the time of the damage and might tend to retard the conversion of existing manual systems to automatic dial systems which has been in progress in the telephone industry over the past decade.

Independent Pioneers Organize Woods Chapter

Named in honor of the founder and president of the Lincoln Telephone & Telegraph company, the Frank H. Woods chapter of the Independent Pioneer Telephone association of America received its charter and announced officers during a picnic at the Woods home June 21.

Officers of the 150 charter members attending are C. P. Russell, Lincoln, president; Chris Haberman, Friend, vice-president Flora M. Johnson, Lincoln, secretary and J. H. Hartley, Lincoln, treasurer. On the executive committee are George Hansen, Mrs. Cecil Anderson, H. W. Wheeler and Elsie Anderson, all of Lincoln, and James Oudgeon, Hastings.

Charter was presented by J. R. Johnston of Indianapolis, secretary-treasurer of the national association. L. E. Hurtz, of Omaha former general manager of the Lincoln company, presented a protrait of Mr. Woods, and the latter spoke of his experiences in early days.

Company Was Prepared for Subway Strike

To insure normal operation of telephone service in the event that a strike on the New York City subways called for June 30 had come off, the New York Telephone Co. had arranged to provide accommodations in hotels for 2,000 of its operators who do not live within walking distance of work. Mayor LaGuardia and the Transport Workers Union reached an agreement June 28 postponing any action until the courts decide on adjudication now before them, but in case negotiations collapse and the strike is staged in the future, the telephone company will undoubtedly repeat the same arrangements.

Because a tie-up of transit facilities was expected to increase telephone traffic sharply, the company had intended to keep operators at hotels near the central offices. In Brooklyn and the Bronx plans had been made to provide transportation for an extra large force of operators in buses and private automobiles. Similar arrangements had been prepared by the Long Lines Department of the A. T. & T. for several hundred operators of the New York long distance offices.

John Agee, general manager of the Lincoln Tel. & Tel. addresses the newly formed Frank Woods Chapter of the Independent Pioneer Telephone Association at it's organization meeting. (Picture courtesy Norman Ott, L. T. & T.)

g. 1—Modern Portable Type Wheatstone Bridge De-gned for the Telephone Field. (Courtesy Leeds & Northrup Co.)

How then can high resistance faults be located? It is the writer's firm belief that there is no substitute in cable plant testing for the Wheatstone Bridge method. Contrary to popular understanding the Wheatstone Bridge is not difficult to use and it embodies only the simplest electrical principles and requires only elementary multiplication, subtraction, and division to compute the distance to the fault after the measurement is taken.

Even the smaller exchanges will find that a Wheatstone Bridge will over a period of years more than pay for itself and that a bridge will also avoid prolonged interruption of service.

other resistance arms controlled by a single **multiplier dial,** and generally known in schematic diagrams as Resistance **arms A and B** two terminals known as $\mathbf{X_1}$ **and** $\mathbf{X_2}$ (the X arm) a sensitive direct current **galvanometer,** and several **keys** for connecting the battery and galvanometer in the circuit.

Theory of Basic Bridge Circuit

SPACE does not permit going into a lengthy discussion of Wheatstone Bridge theory other than to say that when reduced to its simplest elements it involves four resistance arms, with a source of direct current, usually a battery connected at the junction of A and

CABLE FAULT LOCATION with a WHEATSTONE BRIDGE

By C. F. PETERSON

General

THERE is nothing as disturbing to a telephone man as cable trouble, particularly if it is of the high resistance variety. Unless cable testing methods are well organized and understood, it is like looking for the proverbial "needle in a haystack" to find a pin hole sheath opening.

The majority of cases of cable trouble result from sheath openings which admit moisture causing the cable pair insulation to breakdown creating crosstalk and cross ringing and in some cases grounding the lines sufficiently to prevent their use. Some of these sheath openings can be located by walking under the cable and visually inspecting the sheath, particularly at points where it passes through trees, at sleeves, corners, and other potential trouble points. Many cases of trouble cannot be located by this method as they may be due to a tiny pin hole under a cable ring or a crack due to crystallization.

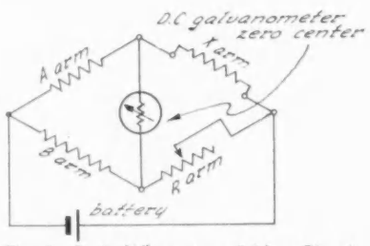


Fig. 2—Basic Wheatstone Bridge Circuit.

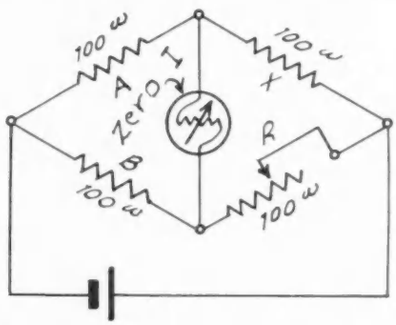


Fig. 3-A—Electrical Conditions in a balanced bridge circuit with equal ratio arms. (100:100=100:100)

Wheatstone Bridge Construction

IT should be kept in mind that the chief advantage of the Wheatstone Bridge over other types of resistance measuring instruments, aside from its exceptional accuracy, is the fact that the resistance from any point to a cable fault can be measured and **the resistance of the fault will not affect the accuracy of the computation.** A popular type of Wheatstone Bridge particularly designed for the telephone field is illustrated in Figure 1. The Bridge consists essentially of a calibrated and adjustable **rheostat arm** (R arm) controlled by four dials, two

B and R and X arms, and with the galvanometer connected across the junctions of the A and X and B and R arms as shown in the schematic diagram in Figure 2. When all of the resistance arms are of the same ohmic value the galvanometer will show zero deflection. This is due to the fact that the potentials across the various arms will be equal, hence there is no voltage available to force current through the galvanometer when the bridge arms are balanced. However, if the resistance in the several arms is not equal the bridge will be unbalanced and current will flow through the galvanometer. The magnitude of the galvanometer deflection is not important as it serves merely as a null indicator, that is, to show when the bridge is balanced. A balanced condition can exist

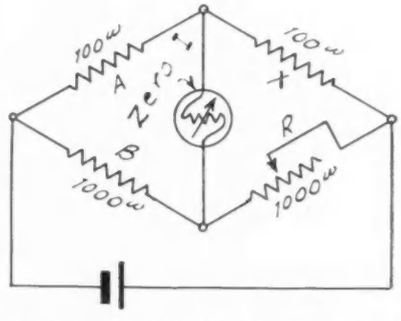


Fig. 3-B—Electrical Conditions in a balanced circuit with unequal ratio arms. (100:1000=100:1000)

even though the resistance values are not all equal in the several arms provided they bear definite ratio to each other. Fig. 3 illustrates by actual values the two conditions for a balance. For the bridge to balance the several arms must bear the following resistance ratio:

$$A : B = X : R$$

Use of the Bridge in Locating Cable Trouble

NOW let us consider just how the Wheatstone Bridge would be used in the location of a ground in a telephone cable using what is known as the simple Varley method.

The first step is to locate a good wire in the same cable with the bad wire. A good wire is one which shows no leak. Connect the good wire to the X_1 terminal of the bridge and connect one of the bad wires to the X_2 terminal. *Strap* the good and bad wire together at some distant terminal which is known to be beyond the fault. The end terminal for example. Connect the ground terminal of the bridge to the central office ground, or any available earth connection.

Step No. 2—With the ratio dial, which controls the value of the resistance cut in the A and B arms, set on 1.0, set the rheostat dial of the bridge on 1000 ohms and close the battery and galvanometer keys and note whether the needle deflects toward the negative or positive side of the galvanometer scale. If it is the positive side (marked +) we know that we will need to cut in more resistance in the rheostat to balance the bridge. If the deflection is towards the negative side of the scale, we will need to cut some resistance out. Adjust the rheostat until a balance is obtained which will be shown by zero deflection of the galvanometer.

Adjusting the Rheostat Arm

It is important that an orderly procedure be followed in adjusting the R arm to balance the bridge. To illustrate set the hundreds, tens, and units dials all on zero, and adjust the thousands dial until the balance point is located between two points on this dial. Set the dial on the smaller value. Then proceed to the hundreds dial and locate the balance point between two points on this dial and then set on the smaller value, and do the same for the tens and units

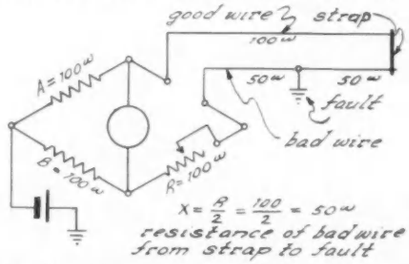


Fig. 5—Actual values in a typical fault case using Simple Varley Method.

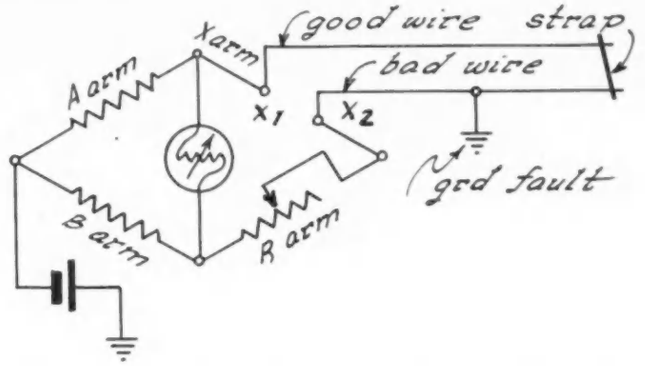


Fig. 4 — Schematic connections for Simple Varley Test on Cable Pair.

dial. The value cut into the R arm to balance the bridge can then be read directly from the dial settings. Call this reading R

Step No. 3—Next compute the resistance from strap to fault by simply dividing the rheostat setting by two, i.e.,

$$X_1 = \frac{R}{2}$$

When: X_1—Resistance in ohms strap to fault.

R—Rheostat Setting

$\frac{A}{B}$ —Must equal 1.0

Step No. 4—After obtaining the resistance from strap to fault we next convert this into feet by multiplying the **feet per ohm factor** (see table No. 1) for the gauge cable involved. For example, suppose the cable from strap back toward the office is *22* gauge, then the theoretical distance strap to fault would be—

$d = 50 \times 61.68 = 3084$ feet (strap to fault)

Figure 5 shows how actual values would work out in a typical fault location case.

Reason that Fault Resistance Does Not Affect Accuracy

AN understanding of how the Wheatstone Bridge is able to locate faults in telephone circuits without the resistance of the fault itself affecting the accuracy of the readings obtained can be better appreciated by a study of Figure 6. This figure shows how the resistances of good and bad wires appear in the basic Bridge circuit. It will be noted that the X arm, instead of consisting of a lumped resistance, consists of all of the resistance of the good wire plus the resistance of bad wire from strap back to fault. The R arm consists of whatever resistance may be inserted by the rheostat plus the resistance of bad wire from fault to Bridge.

Inasmuch as the Simple Varley method requires that the ratio dial of the Bridge be set on 1.0, then the X arm resistance must equal the R arm resistance to balance its bridge. We must therefore cut in enough resistance in the rheostat so that when added to the resistance of bad wire (strap to fault) it will equal the X arm, which is made up of all of the good wire and part of the bad wire.

It requires that just twice the value of the resistance of the bad wire (strap to fault) be cut into the rheostat for the R arm to equal the X arm hence, when computing the resistance of strap to fault, we divide by two, i.e., $X_1 = \frac{R}{2}$

It is a basic requirement of the Simple Varley method that the ratio arms be set on 1.0 and that the good and bad wires have approximately the same resistance.

The Advanced Varley Method

THERE is another method that can be used which eliminates these two requirements. This method requires that two good wires be available and that two readings be taken. The good and bad wires need not have the same resistance and can even be in separate sheaths. The following steps illustrate the application of this second Bridge method, which we will call the advanced Varley method.

Step No. 1—Pick out two good wires and call these G_1 and G_2. Connect the two good and one of the bad wires together at a terminal known to be beyond the section in which the fault is thought to exist.

Step No. 2—At the office connect good wire No. 1 to the X_1 post of the Bridge, good wire G_2 to the ground post and the bad wire to post X_2. Set ratio dial on 0.1. Balance bridge and call reading R_1.

Step No. 3—Disconnect good wire G_2 from the ground post of the Bridge and connect the ground post to ground with the ratio arm still on 0.1 Balance the Bridge and call reading R_2.

Step No. 4—Compute the resistance from strap to fault by subtracting reading R_1 from R_2 and multiply by .0909, i.e.,

$$X_1 = (R_2 - R_1)\ .0909$$

The distance to fault is then computed by multiplying the value of X_1 by the feet per ohm for the particular gauge cable involved.

Ga.	F. Per Ohm
19	124.2
22	61.95
24	38.96

Table No. 1—Feet per ohm at 68° F

(Please turn to page 38)

THE *Only one*

THE Cook Six-Pair XB Unprotected Pole Cable Terminal is the **only** six-pair terminal designed, engineered, built and sold as a six-pair job. It is the only six-pair terminal that gives you **all** the quality features found in the larger Cook XB terminals.

. . . patented one piece Bakelite face plate and insulating fanning strip . . . sturdy, non-corroding Everdur studs with tinned solder shoulders firmly embedded in mounting plate so they cannot turn or loosen . . . raised stud mountings that eliminate surface leakage . . . studs correctly positioned for quick, convenient wiring . . . non-corrosive nuts and washers for quick, low-resistance connections.

The same patented cable entrance and holding sleeve for tight cable joint . . . the same exclusive process for compound filling insuring against shorts and grounds . . . the same heavy reversible zinc hood for mounting with stub from top or bottom . . . the same hot dip galvanized alloy steel frame . . . **the same five star features all the way through the six-pair XB that are found in the larger sizes.**

The Cook Six-Pair XB has a variety of uses and will save in installation and maintenance costs many times its low purchase price. Buy the Six-Pair XB from any telephone manufacturer or supply house.

COOK ELECTRIC COMPANY 2700 SOUTHPORT AVENUE CHICAGO

Wire Chiefs TRAINING COURSE

SECTION V

Pole Line Fixtures

(Prepared Expressly for TELEPHONE ENGINEER by the Lincoln Engineering School)

General

EVERY telephone man should be familiar with the general features of outside plant construction as this information is useful and interesting even though one is engaged in some other phase of telephone work.

This section of the training course deals with pole line construction and covers such items as pole framing, bracket and crossarm arrangements, dead ends, etc.

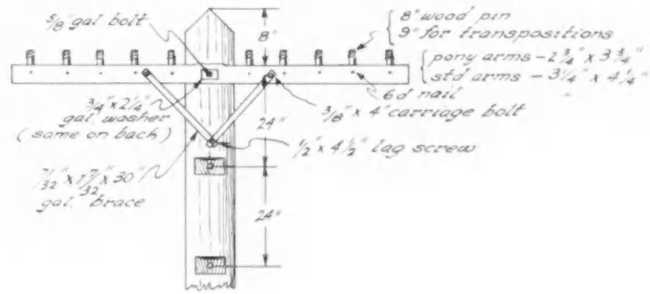

5/8" gal. bolt
8"
8" wood pin
9" for transpositions
pony arms – 2 3/4" x 3 1/4"
std arms – 3 1/4" x 4 1/2"
6d nail
3/4" x 2 1/4" gal. washer (same on back)
24"
3/8" x 4" carriage bolt
1/2" x 4 1/2" lag screw
7/32" x 1 7/8" x 30" gal. brace
24"

Fig. 3—Detail of Ten Pin Crossarm Lead.

Pole Framing

THE term **Framing** refers to the cuts that are made in a pole top so that it will shed water, and the recessed cut and hole (known as a gain) that is necessary for each crossarm.

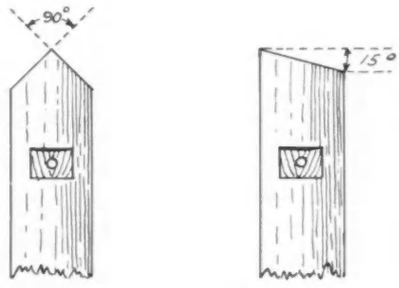


Fig. 1—Two types of Pole Roofs.

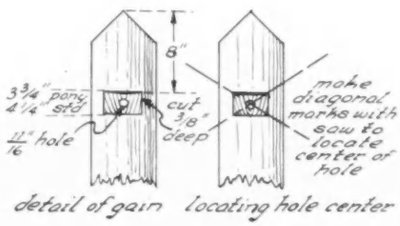

8"
3 3/4" pony 4 1/4" std.
11/16" hole
cut 3/8" deep
make diagonal marks with saw to locate center of hole
detail of gain
locating hole center

Fig. 2—Detail of Pole Gains.

The pole suppliers will furnish poles already framed where desired at a slight additional cost. It is particularly desirable that poles such as yellow pine which have received full length treatment be purchased fully framed for the maximum number of gains that may be required, otherwise untreated wood would be exposed if gains are cut after the poles have been treated.

When it is necessary to **roof** poles in the field either a double or single cut roof may be used. Figure 1 illustrates the two types of roofs. The double cut roof presents a more symetrical appearance, but it is claimed that the one way roof reduces checking at the top of the pole. Poles should always be roofed so that the sides of the roof are at right angles to the face of the pole. Poles should be held in a **gaining buck** when cutting roofs or gains.

Where poles are purchased with gains already cut, a sufficient number of gains to care for the ultimate number of crossarms likely to be carried should be specified.

Most of the larger companies find it economical to purchase all poles with gains already cut. The number of gains specified is based on pole height and class.

Gain Locations

THE purpose of the gain is to "key" the crossarm into the pole and provide a flat surface against which the arm can be bolted. This makes the arm much more rigid than would otherwise be the case.

The gain should be at right angles to

(Please turn to page 40)

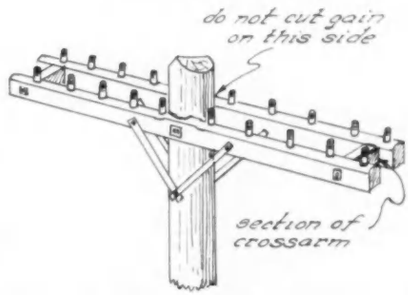


Fig. 4 — Method of Double Arming at Dead Ends.

Your choice of either

STROWGER SWITCHING EQUIPMENT *or* **ROTOR RELAY SWITCHING EQUIPMENT**

The Automatic Toll Board can now be obtained equipped with switching apparatus of either the standard Strowger type or the highly ingenious Rotor Relay type, whichever is preferred.

For Truly Modern Toll Service, You Need All These Features!

Meets latest CLR operating practices.
Maximum flexibility to meet growth and future traffic needs.
Designed to meet long distance network dialing.
Call switching under control of finger touch keyboard.
Automatic class of service identity.
Direct display of circuit number and circuit groups.
Automatic selection of available lines and trunks.
Pushbutton control of connection release.
Increased line and trunk efficiency.

This list represents only a brief selection of 42 important features of operation incorporated in this board. No toll board is completely modern unless it gives you all of these advantages. No matter how small or large a toll board you require, you should investigate these 42 features most carefully before making a decision. Send for this list—today!

THE AUT

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"WHAT will the Automatic Board telephone executives are ing tod

It will permit you to pr de, bett service at less cost per call, a d meet confident of continued profitab eration.

How is this accomplished? Prim by usi the operator of the arduous m nical o pleting a call. With the Autom Toll Bo a few simple keys to make a co tion.

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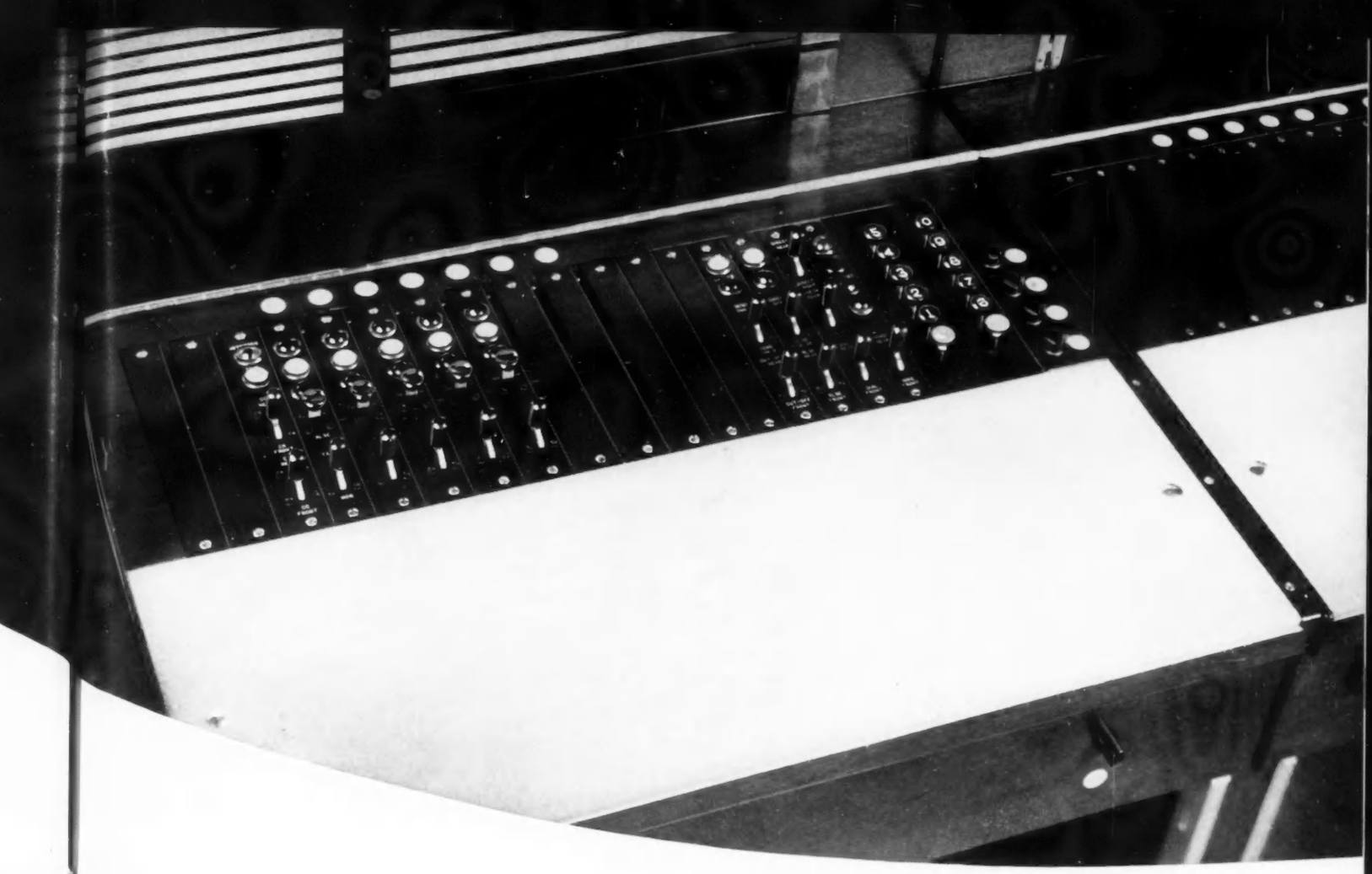

AUTOMATIC TOLL BOARD

faster, more profitable toll service through remote control switching!

utomatic Board do for me?"—is the question tives are ing today. Briefly, the answer is this:— ou to pr e, better, faster, more convenient toll call, and meet changing economic conditions profitable eration.

d? Prim by using switches or relays to relieve luous manual operations associated with com- Automatic Toll Board, she has merely to actuate ke a conn tion.

The result is faster, smoother, more accurate service. The operator's attention is not dissipated—it is concentrated on the essentials of each call. Sitting comfortably at the cordless, plugless, jackless board of desk height, she has no stretching or reaching to do—is much less fatigued at the end of the day. She can handle more calls per hour, with greater precision and reduced nervous strain—thus lowering cost per call and improving service as well.

Adoption of the Automatic Toll Board would be a major forward step, both technically and economically, for your exchange. Write for further information, today!

AUTOMATIC ELECTRIC

ORIGINATORS AND DEVELOPERS OF STROWGER STEP-BY-STEP MACHINE SWITCHING AUTOMATIC DIAL SYSTEMS

MAKERS OF TELEPHONE, SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

Distributors in U. S. and Possessions:
AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 W. Van Buren St., Chicago, U.S.A.
Export Distributors: AUTOMATIC ELECTRIC SALES COMPANY, LIMITED

Expanding Plant

Central plant equipment of the San-Angelo Tex. Telephone Co. will be expanded from 4,000 to 5,000 lines under a program now well under way.

The expansion is expected to be completed within four months or by the time the November directory is published, said Marion Clay, superintendent of the installation program.

The addition in lines to serve the city's modern dial system of telephone communication was necessitated by an ever increasing usage, one that wasn't occasioned by the Air Corps development here alone, Clay said.

A large number of extra workers is employed on the installation.

Somerton Telephone Exchange Sold

Pleading that her physical condition no longer permits of her operation of the plant Iva McKeen, recently petitioned the Commission for authority to sell the phone Exchange, south of Barnesville Ohio, to G. A. Burcher for $650.00 Both parties are residents of Somerton.

The authority asked was granted. The Exchange now has 52 subscribers.

Installation Gain

There was a gain of about 68,300 telephones in service in the principal subsidiaries of the American Telephone and Telegraph Company included in the Bell System during the month of June, 1941.

The gain for the previous month was 121,200 and for June, 1940, 18,100. The net gain for 6 months this year totals 673,300 as against 449,000 for the same period in 1940. At the end of June this year there were about 18,155,300 telephones in the Bell System.

The gain for June 1941 was the largest for the month of June in the history of the Bell System, the next largest June gain having been 56,539 in 1923.

Signal Corps Opens Candidate Officers School

The first officers Candidate School of the Signal Corps since the first World War was opened July 1 at Fort Monmouth, N. J., with a three months course of instruction prepared for 500 men from over the nation. Similar courses are being planned for Oct. 1, 1941, and Jan. 1, 1942, and graduates will be commissioned as Second Lieutenants in the Signal Corps Reserve. For the first three months course, 68 men were chosen from Fort Monmouth.

Subject: The 2-B Regrettor —It's Author

Boston, June 24, 1941

Mr. Ray W. Smith, Editor
TELEPHONE ENGINEER
7720 Sheridan Road
Chicago, Ill.

On February 7, 1941, I disclosed to you who it was that wrote that classic which appeared in the January TELEPHONE ENGINEER entitled, "The No. 2-B Regrettor," or words to that effect.

I told you it was James M. Henry, Radiotelephone Engineer, of the Chief Engineer's Department, of the New England Telephone & Telegraph Company, 125 Milk Street, Room 312, in Boston, Mass.

I also mentioned he was slated to be head man of the Boston Section of the Institute of Radio Engineers.

It is now a fact. He was elected Chairman of the Boston Section, of the Institute of Radio Engineers, at its annual meeting, in MIT, on June 6, 1941.

I know—because I also belong to it—and I was at the meeting in question.

There is no point in keeping quiet on the authorship of the pamphlet on the 2-B Regrettor, because Henry knows I wrote and told you who did it.

Gordon S. Wallace
15 Bothwell Road
Brighton 35
Massachusetts

(Editor's Note) Thanks to Mr. Wallace in our efforts to locate the author of the article mentioned. It caused many requests for extra copies of our January issue. And thanks to you, JAMES M. HENRY!

Highlight of the Communications News

(Continued from page 18)

its service being predominant in small towns and rural areas. The tax will be paid by the subscribers and might have the effect of diminishing subscriber business due to this additional charge. It might occur that the Independent telephone industry may present an exposition of this levy's injurious effects upon the small telephone companies when the tax measure comes before the Senate Finance Committee for additional hearings.

For Vacancy

THE FCC is now functioning on a six Commissioner basis because Roosevelt has not yet filled the vacancy of the post, held by Frederick I. Thompson, Alabama newspaper publisher, whose term expired June 30. Who the President will appoint is difficult to foretell and, while he has not been advised about his retirement by the White House, Commissioner Thompson has a most slim, if any, chance of reappointment.

Mr. Thompson left for his Alabama home June 30 when his term expired without word from the White House as to whether there were any indications in regard to a reappointment. Even though Senator Hill of Alabama, now the Senate majority whip, has declared he is supporting the reappointment and a number of "liberals" in the House are urging Mr . Thompson's continuance in office, the odds seem to be most strongly against the selection of the Alabaman.

There have been several aspirants already mentioned for the FCC post. Two state commissioners' names have been cited—Hugh White, head of the Alabama commission and Leon Jourolmon, Jr., of the Tennessee commission —, but there seems little liklihood that another FCC member will be drawn from state commission ranks since there are two such Commissioners, Paul A. Walker and Ray C. Wakefield. The broadcasting industry, too, objects to state commission experience as tending to impose "utility" regulatory ideas on the radio industry. A leading candidate

is G. U. Johnstone, Jr., former Democratic National Committee radio director, and another prospect is one of the leading members of the Maine Democratic Party, Fulton J. Redman.

It seemed a good possibility that the President might delay for sometime in the selection of the new FCC member until the Senate Interstate Commerce Committee had decided upon any course of action in regard to the FCC network monopoly regulations.

In the meantime, the work of the joint FCC-State Commission committees in the study of the best methods to determine separation of telephone property and revenues is at a standstill following the conferences between the two groups in Washington during mid-June. The committees probably will not meet again until the annual convention of the National Association of Railroad and Utilities Commissioners in St. Paul during the latter part of August. The state commission committee is composed of Commissioners Nixon of Wisconsin, Murphy of South Dakota, Hamley of Washington State, Jouralmon of Tennessee and Beamish of Pennsylvania who met with FCC Chairman Fly and Commissioners Walker and Wakefield. In addition the Commissioners are assisted by FCC staff members and state commission accountants and engineers with this expert group, headed by E. F. McNaughton, director of public utilities of the California Railroad Commission, who is regarded as one of the ablest regulatory officials in the country. The separation studies will be discussed at the NARUC convention in reports by Commissioner Nixon and Chairman Fly.

Miscellaneous Notes

The FCC and the broadcasting industry have been conducting secret conferences to compose their differences on the FCC network monopoly regulations and it is doubtful that the Senate will approve an investigation of the Federal commission because of this order.

Hearings on the New Jersey Bell's application to acquire the Imperial Securities Co., a Gary subsidiary, as the first step for the consolidation of the Keystone Telephone System in Philadelphia and Southern New Jersey into the Bell System, are to be resumed by the FCC in Philadelphia early in September for the purpose of securing additional views about the change from Keystone subscribers..

Legislation to permit the FBI to tap telephone wires against espionage, sabotage and major crimes was killed for the present session of Congress by the House rejection of such a measure.

Benedict P. Cottone who has been with the FCC for the past year and a half and who had previously served with the SEC, the Power Commission, Justice Department, CAA and the FCC Telephone Investigation, is now the FCC Assistant General Council in charge of telephone, telegraph and other communication matters. He succeeded James A. Kennedy who became the General Counsel of the cable and radiotelegraph companies of the International Telephone and Telegraph Corporation.

The final link in the nation's first transcontinental telephone cable to cost $20,000,000 which marks a new milestone in telephone history was speeded towards construction by the FCC when it approved the joint application of the American Telephone and Telegraph Company, the Pacific Telephone and Telegraph Co. and Bell Telephone Co. of Nevada to install twin buried cables between Salt Lake City and Sacramento, a distance of 607 miles, which will complete the link from Omaha and connect with the eastern cable network at Omaha and the cable system on the Pacific Coast at Sacramento. The FCC also approved a project of the A. T. & T. and the New England Telephone and Telegraph Co. to build a new toll route from Massachusetts to Maine of twin buried cables so as to take the toll system away from the Atlantic Coast as a national defense safeguard.

CLEARS TROUBLE IN A HURRY

Averages $6.00 Saving per Fault

This easy-to-use Wheatstone Bridge puts its finger on faults—locates grounds, crosses or opens—enables trouble-shooters to clear lines or cables in minimum time.

A recent survey among users indicates that this Test Set saves from 1 to 8 hours in locating faults, as compared with other methods. In terms of man-hour cost of trouble-shooting, it saves an average of $6.00 per fault. From this average figure, it appears that after locating 21 faults the instrument has saved enough to pay for itself. After its 21st location, this test set is actually earning money.

These savings, as well as the benefits of subscriber good-will are yours with the purchase of one of these Test Sets. Price is $125.00. If more information is required, write for Catalog E-53-441(1).

A Free Handbook explaining methods of using this Bridge for locating grounds, crosses, opens and other faults, will be sent on request. Write for Note Book E-53-441 "Notes on Fault Location in Cables."

5430-A Type U Test Set

LEEDS & NORTHRUP COMPANY, 100 E. LOGAN ST., PHILA., PA.

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MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad E-53-441(4)

Conducted by B. C. BURDEN, Technical Editor

Line AND Desk

Inductive Interference Tests

Q. Is there any simple test unit available for measuring the amount of noise present on telephone lines?

A. No. The Bell Company has developed a vacuum tube unit with a special filter by means of which noise measurements can be made. However, these units are quite elaborate and not suitable for general use. It is of course possible to measure the induced voltage between telephone lines, wires, and ground, however this measurement merely gives some notion of noise tendency and has little real value.

Q. What type of voltmeter can be used to measure induced power voltage between telephone wires and ground?

A. A copper oxide A.C. voltmeter is most commonly used for this purpose. The instrument should have an impedance of at least 1000 ohms per volt and preferably higher.

Transmission Tests

Q. Can ordinary A.C. voltmeters be used to make transmission tests?

A. The standard soft iron vane type A.C. voltmeter will not respond efficiently to frequencies above 133 cycles, hence cannot be used in making 1000 cycles transmission tests. A copper oxide type meter is usually employed.

Q. What is the purpose of the 20db pads which are arranged to be cut into the Wire Chief's telephone circuit on some testboards?

A. These pads are for the purpose of detecting circuits which may have excess loss due to bad splices or other causes. By raising the normal circuit loss toward the maximum value, it is possible to detect abnormal losses that would pass unnoticed at higher voice levels.

Q. Is a power level meter necessary when feeding radio program material into a telephone cable or out over a toll line?

A. It is always good practice to connect a power level meter across the input of any radio or P.A. pickup circuit which feeds into telephone lines. The level of the material should be kept to below plus 6 db (.006 watt zero level). This will minimize the program material crosstalking into other telephone circuits.

Line Tests

Q. Is the ohmmeter useful in locating faults in telephone cable?

A. The ohmmeter is very useful in detecting trouble and identifying good and bad wires in a cable, but it is not useful in determining the number of feet to the point of trouble.

Q. Can an ohmmeter be used to detect tree leakage?

A. Good ohmmeters equipped with several scales are available which will measure leakage as high as 10,000,000 ohms, hence are well suited for detecting any type of leakage.

Q. What is the best method of using the ohmmeter in measuring a line for high resistance splices?

A. The line should be checked on a mile by mile basis, and whenever the measured resistance of a mile of line is more than 10% above the resistance of new wire, the line should be checked on a ½, ¼ and ⅛ mile basis until the defective splices are isolated.

Q. Will an ohmmeter give useful tests on repeating coils, generators, ringers, etc.?

A. An ohmmeter is very useful for detecting trouble in telephone apparatus, inasmuch as opens, shorts, and grounds are readily determined. It can even be used to check the capacity of condensers.

Q. How is a condenser checked with an ohmmeter?

A. The ohmmeter is connected across the condenser terminals and the magnitude of the momentary "kick" or deflection which results when the ohmmeter is first connected is a measure of condenser capacity. By comparing the kick obtained with the condenser under test with that of a condenser of known capacity, an approximate determination of condenser capacity is easily obtained.

If a permanent deflection results when the ohmmeter is connected, this means that the condenser insulation is defective and that the condenser should be replaced. The highest resistance scale of the ohmmeter should be used in checking condensers.

Cable Tests

Q. What limitation on cable faults does a Wheatstone Bridge have with reference to fault resistance, type of good wire available, accuracy of measurement, etc.?

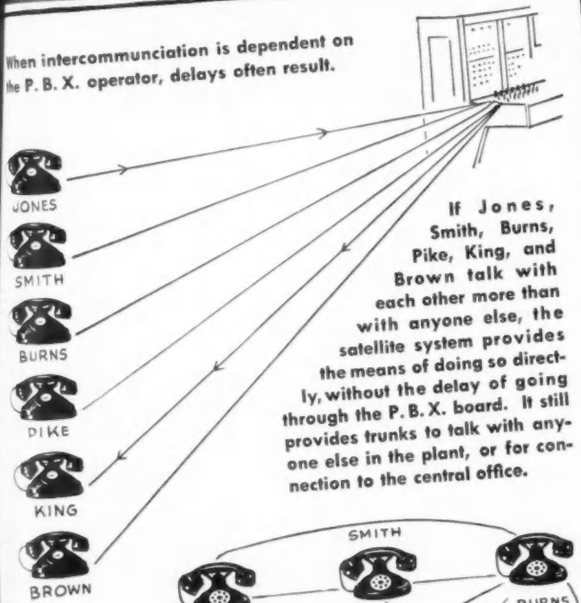
A. A good bridge man can locate faults whose resistance is as high as 100,000 ohms without any difficulty and up to 500,000 ohms with fair accuracy. The nature of the good wires (two required for three Varley method) is not important and they may be in another cable, open wires, magnet wire, etc. without affecting the accuracy of the reading, provided the three Varley method is used.

Q. What advantage does the Varley Method have over the Murray Method of locating cable faults?

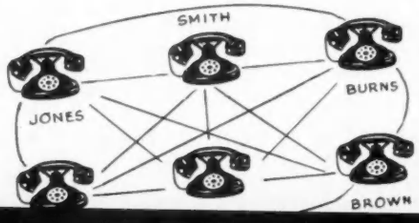
A. The Varley Method is easier to understand and when used on a Three Varley basis, offers the advantage of giving a complete check of the fault location and with the results being independent of good wire length and resistance. The Varley method is the preferable method.

SPEED
IS THE WATCH-WORD
TODAY

When intercommunciation is dependent on the P. B. X. operator, delays often result.



If Jones, Smith, Burns, Pike, King, and Brown talk with each other more than with anyone else, the satellite system provides the means of doing so directly, without the delay of going through the P. B. X. board. It still provides trunks to talk with anyone else in the plant, or for connection to the central office.



With a satellite system, connections are instan-

SELL STROMBERG-CARLSON CONVENIENCE SYSTEMS AS P. B. X. SATELLITES

Manufacturing plants rushing to meet the exacting demands of defense orders offer a ready market for Stromberg-Carlson Convenience Systems.

Used as a satellite system working into a P.B.X. switchboard, these systems are particularly useful for intercommunication between departments that must be in frequent contact, as the delay of going through the P.B.X. operator is eliminated.

Trunks can be furnished in three ways —first, individual trunks to each station connected with P.B.X. and one common trunk; two or three common trunks to switchboard; one or two common trunks divided between outside and P.B.X. This gives the satellite group 24-hour service when working overtime.

A typical example is the Stromberg-Carlson 7-6 System. The 8 buttons on each telephone have the following functions: 1 button controls an individual private trunk from every local station to the P.B.X.; 1 button controls a trunk which is common to all 6 stations, also terminating at the P.B.X.; 1 button holds either trunk, and 5 buttons control the individual 6 stations for intercommunication between themselves, wholly independent of the P.B.X. switchboard.

Write for descriptive Bulletins and you will see how Stromberg-Carlson Convenience Systems can bring you added revenue now.

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Branch Offices: Chicago Kansas City San Francisco Toronto

Stromberg-Carlson

Conducted by
R. A. Clark, Jr.

A Voice Frequency Ringer

WITH the recent development of a new high speed composite set suitable for printer operation there will be undoubtedly a number of telephone circuits composited to permit operation of two printer circuits instead of one as obtained with a simplex arrangement. As the high speed composite cuts off the voice circuit at about 300 cycles the 133 cycle type ringers will not operate satisfactorily, however this equipment can be converted to a 1,000 cycle ringer by the addition of a small amount of equipment which is described below.

The added equipment consists of a 1,000 cycle oscillator which is modulated by the 133 cycle interupter. A receiving unit amplifies and demodulates the 1,000 cycle signal supplying 133 cycles to the 218-B (W.E. Co) relay which is mechanically tuned to 133 cycles. The changes to be made on the 511-D panel are shown in Fig. 1. The wires from the S2 relay going to the 91C retard coil are disconnected from the coil and brought to terminals 15-16. Two new wires are run from terminals 17-18 to the 91C retard coil. The 1,000 cycle converter panel is connected to the 511-D panel and the 156-B interrupter as shown in Fig. 1.

The power supply for the converter consists of 110V either D-C or A-C for the filaments and either 110 or 160 V D-C for the plate supply. If a 24 V source is available for the filaments it may be used by reconnecting the tubes and adjusting the ballast tube resistance to the correct value for the 6C8 tube. The power supply connections are shown in Fig. 2 where 110V filament supply is used.

The circuit for the oscillator is shown in Fig. 3. When the A-C relay S1 on the 511-D panel operates (from the PBX ring) 133 cycles is applied to terminals T9 and T10 which in turn modulates the 25L6 (1) oscillator tube. The modulated signal passes from the L4 transformer via terminals T11, T12 to terminals 5-6 on the 511-D panel thence to line through operated relay S2.

At the receiving end the signal passes from the line through the non-operated relay S2 to terminals T13-14 of the re-

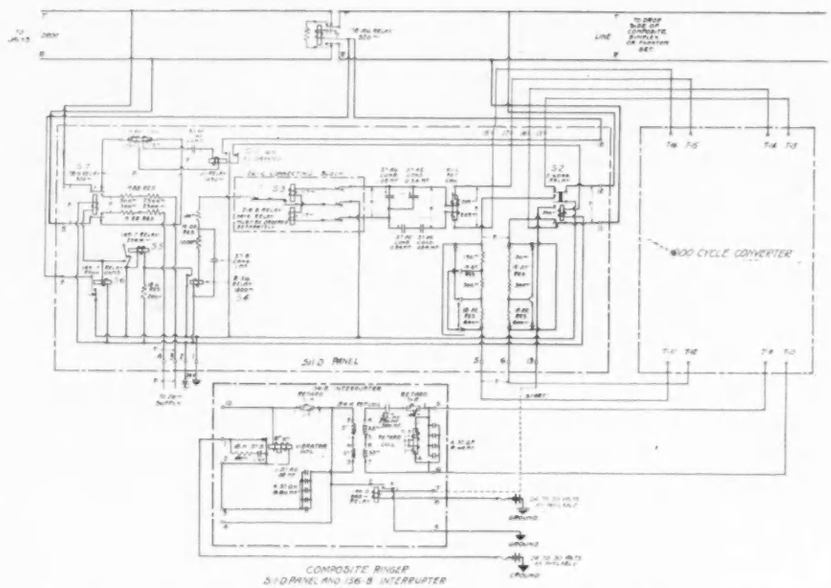

Fig. 1—Composite Ringer Circuit showing Modifications and added Equipment.

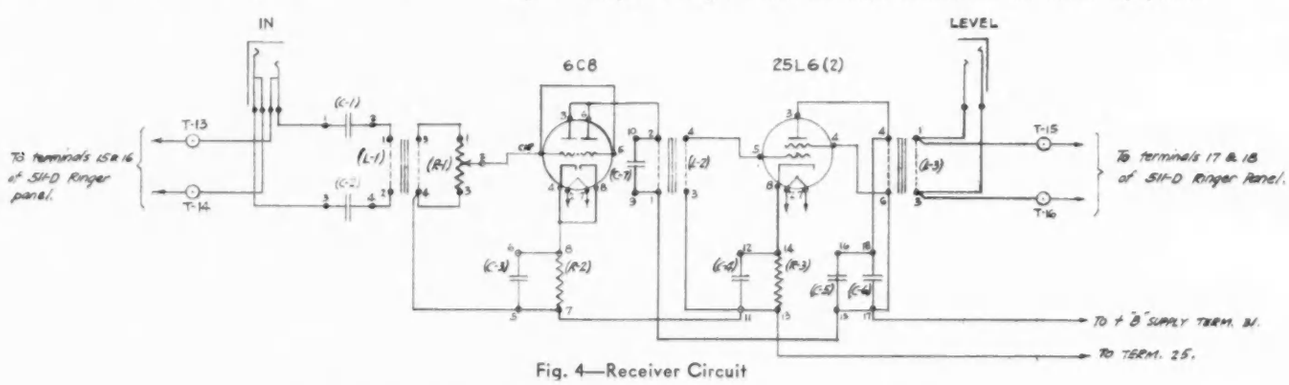

Fig. 4—Receiver Circuit

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Telephone lines are life lines. They carry the communications so vital to our expanding defense program.

The photograph shows wires being made into a telephone cable. Such cable—containing billions of feet of this wire—is being rushed by Western Electric to meet the urgent telephone needs of the armed forces and of industry.

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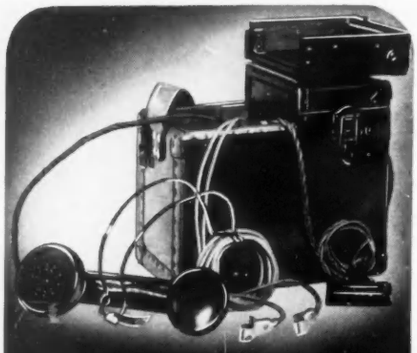
Western Electric *. . . is back of your Bell Telephone service*



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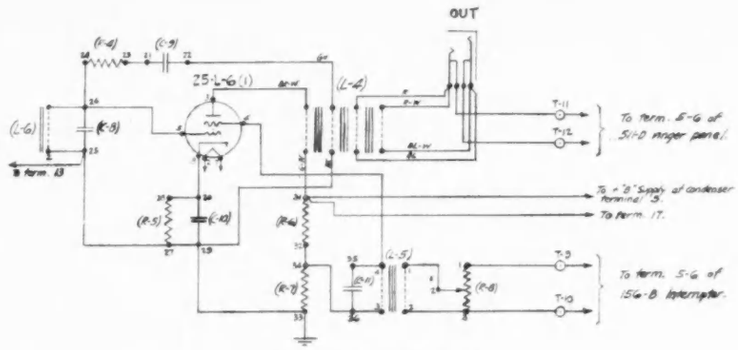

Fig. 3—Oscillator Circuit.

ceiver circuit shown in Fig. 4. The signal is amplified in the 6C8 tube and demodulated in the 25L6 (2) tube. The output of this tube on the secondary side of transformer L3 is 133 cycles which flows through terminals T15, T16 to the 218-B relay thus causing it to operate. Operation of this relay results in 16 cycle voltage applied to the telephone drop. Table 1 shows the values of the components used in the converter. Transformers similar to those shown may be found in a radio supply store. In lining up the circuit a 10 db pad should be connected from the output jack to the in put jack and an A-C voltmeter or transmission level meter connected in the level jack. Operate relay S2 on the 511-D panel and adjust potentiometer R-8 until the voltage in the level jack is maximum for a given setting of potentiometer R-1. This procedure should be followed at both

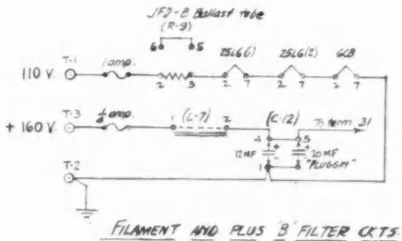

Fig. 2—Power Supply Circuit.

stations then one should ring the other and the potentiometer R-1 adjusted until satisfactory operation of the 218-B relay is obtained.

The output of the modulated oscillator circuit is about +10 DB and the receiver sensitivity is sufficient so that satisfactory operation will be obtained on circuits having equivalents up to 25 DB.

TABLE I

R-1	500M Ohm Central Pot.	C-7	.02 MF 400VDC Tune to 1,000 cyc.
R-2	750 Ohm 1 Watt	C-8	.005 MF 400VDC Tone to 1,000 cyc.
R-3	1500 Ohm 1 Watt	C-9	.0001 MF Mica 20%
R-4	50M Ohm ½ Watt	C-10	6-8 MF Electrolytic
R-5	500M Ohm 1 Watt	C-11	1 MF
R-6	7500 Ohm 5 Watt	C-12	12-20 MF Electrolytic
R-7	3000 Ohm 5 Watt		
R-8	1000 Ohm Wirt Pot	L-1	C1-143
R-9	JFD B Ballast Tube	L-2	C1-143
		L-3	C1-110A
C-1	.02 MF 400VDC ⩽10%	L-4	C1-138A
C-2	.02 MF 400 VDC ⩽10%	L-5	C1-143
C-3	6-8 MF Electrolytic	L-6	6032-10
C-4	6-8 MF Electrolytic	L-7	6034-4
C-5	.25 MF 400VDC ⩽10%		
C-6	.25 MF 400VDC ⩽10%		

(END)

Sells Oklahoma Exchange

C. E. Devin, president of the Oklahoma association has announced the sale of the Apache (Okla.) Telephone company to Darwin Farmer of Fletcher. The new owner took charge of the property July 1. Included in the transaction was the building in which the telephone exchange is located.

Mr. Devin bought the exchange from Dr. J. H. Mallory 30 years ago, and has operated it continually since then. Disposal of the exchange means his retirement from active business. He states that he and Mrs. Devin will continue to make their home in Apache.

Mr. Farmer, who is a young man, has had his training in the telephone business with his father, who operates the exchange at Fletcher.

Modern Methods of Transmission Testing

(Continued from page 20)

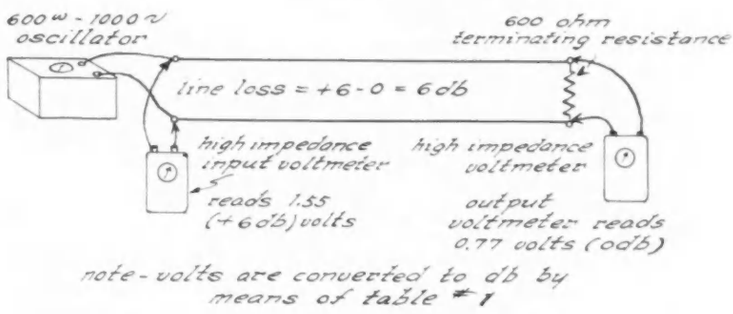
600 w - 1000 ~ oscillator
600 ohm terminating resistance
line loss = +6 - 0 = 6 db
high impedance input voltmeter
high impedance voltmeter
reads 1.55 (+6 db) volts
output voltmeter reads 0.77 volts (0 db)
note - volts are converted to db by means of table # 1

Fig. 6—Example of a Straight-away test by the A.C. Voltmeter method.

1. One 1000 cycle oscillator
2. Two copper oxide voltmeters or power level meters

It is feasible to dispense with one of the voltmeters or power level meters if the oscillator output is stable .With measuring equipment of this type care must be taken in interpreting the readings obtained if error is to be avoided. If the meters used are calibrated in volts then a conversion table such as that shown in Table No. 1 must be used to convert the voltmeter readings into decibels. Such a table is based on the relationship previously mentioned, viz:

$$\text{db} = 20 \log \frac{\text{voltage output}}{\text{voltage input}}$$

Where: Zero reference level is .001 watt at 600 ohms.

The use of tabular values based on this formula assumes that the impedance of the input and output ends of the circuit under measurement are equal. If they are not equal then an error will result unless a corrective factor is applied.

Applications of Power Level Method

TYPICAL applications of the power level method of making transmission measurements are:

1. Straight-away or "loop back" measurements on open wire and cable circuits—exchange or toll.
2. Measurements of switchboard cord circuit losses.
3. Measurement of overall central office loss.
4. Checking the efficiency of repeating coils.

Overall measurement of subscribers circuits can readily be made by connecting the 1000 cycle oscillator to either the subscribers line jack or M.D.F. terminal at the central office and adjusting the oscillator input to some fixed level (in decibels) as shown by a power level meter. The level arriving at the subscribers instrument terminals is then read directly on a second power level indicator (or A.C. voltmeter) and the algebraic difference between the input and output levels represents the line loss in db. For example, if the oscillator is adjusted for an input level of plus 3 db and the meter at the subscribers instrument shows a reading of minus 6 db, this would mean that the overall line loss was +3 db − (−6 db) = 9 db. Comparison of the measured loss with the computed loss will determine whether the loss is abnormal. To illustrate, if the measured circuit consists of three miles No. 22 gauge cable (1.7 db per mile) and ten miles of 109 iron (0.3 db per mile) the computed loss would be 8.1 db and the measured value sufficiently close to this computed loss that the circuit would be considered as satisfactory.

The measurement of toll line loss will follow much the same procedure except that it may be desirable to loop to the sending end (point at which oscillator is located) in order that the testing can be handled from the one end. The loop back measurement will of course embrace the combined loss in the two lines.

The input level at the sending end may be anything from zero to +10 db, the exact value being unimportant. However, it is better to keep the input level to less than +6 db when working on important toll lines in order to avoid objectionable crosstalk into working circuits. The input level should preferably be high enough so that readings will fall near center scale of the output meter. Copper oxide meter scales are cramped and hard to read at the low end of the scale, hence the desirability of having an input

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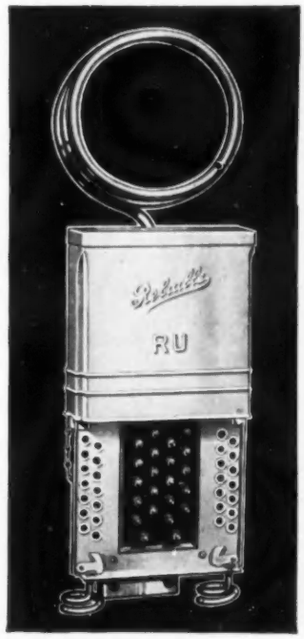

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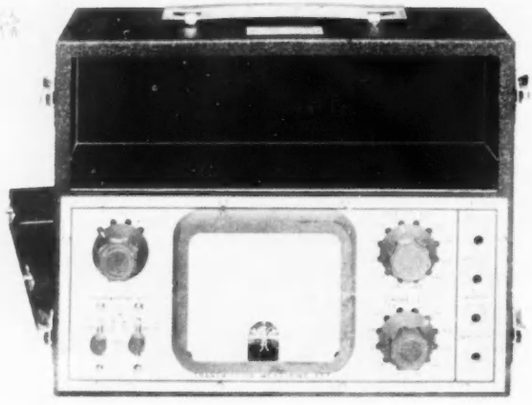

Fig. 9 — Clough Brengle complete transmission measuring set. (Courtesy Clough-Brengle Co.)

level sufficiently high as to give a substantial reading.

Measurement of Losses In Apparatus

THE measurement of transmission losses in apparatus such as repeating coils, induction coils, or complete switchboard cord circuits is readily accomplished by the power level transmission method. For repeating coils and cord circuits the procedure is the same as has been described for telephone lines. The losses of good repeating coils and cord circuits seldom exceed 0.75 db, hence it is necessary to adjust the input level to a value that will give a reading well up on the scale of the output meter if an accurate reading is to be obtained.

Induction coils can best be measured by comparing the reading obtained through the coil under test with that through a new coil of the same type. Because of the inequality ratio of the windings of an induction coil, the readings in db do not have true significance and can only be used on a comparative basis.

Effect of Impedance of Source and Load on Accuracy of Measurements

IT is important that anyone who makes transmission measurements have a good appreciation of the effect on the decibel readings of the impedance at the input and output ends of the line or apparatus under measurement. Let us consider the precaution that should be observed in this regard in order to get accurate measurements.

If we are dealing with a telephone line, either cable or open wire, we should think of it as having a fixed characteristic impedance of roughly 600 ohms. This is of course only an approximate value but for all non-loaded circuits is close enough for practical purposes. In normal operation it has connected to its two ends telephones whose impedance is also approximately 600 ohms. This is the ideal set up for maximum transfer of power from the talking telephone to the listening telephone, i.e., the impedance of the source and load must match the impedance of the line. Now, if we wish to measure the transmission loss between the sending and receiving telephones, how can we do it? As has already been explained we connect an oscillator across the input to the line and a power level meter across both the input and output ends of the line. Now, if the readings as shown by the input and output meters are to be accurate, the impedance of the oscillator plus the input meter connected across it, must equal the input impedance (600 ohms) of the line. Likewise the impedance of the output meter must also be the same as the output impedance of the line. From this it can be seen that the oscillator and power level meters used must be designed to work with telephone circuits and must have the same impedance as the telephones and line if accurate readings are to be obtained.

To show how an error may result from failure to recognize the importance of the impedance relationship, assume that a transmission measurement is being made on subscribers line circuit and that at the output end a 600 ohm power level indicator is connected across the line, but that through oversight the receiver of the subscribers telephone is left off the hook. When the readings are taken the output meter will give a reading lower than it should due to the terminating impedance being 300 ohms (two 600 ohm impedances in parallel) instead of 600 ohms. Thus the line loss would appear to be higher than would actually be the case.

In making measurements of line loss on party lines be sure that all receivers are on the hook.

When ordinary A. C. copper oxide voltmeters are used in transmission measurements, and where the impedance of the instrument is considerably more than 600 ohms (as is often the case) a terminating resistance should be shunted across the meter terminals and will provide an approximate termination that should give fairly accurate results. For example, assume that an 0-3 volt A. C. voltmeter whose full scale resistance is 3000 ohms is used as the output meter. In order to provide a 600 ohm termination at the point of measurement an ordinary 750 ohm resistor should be connected across the voltmeter terminals. This value resistor in combination with the 3000 ohm impedance of the meter will result in a combined impedance of approximately 600 ohms across the line.

Transmission Measuring Sets

FOR the larger exchanges that desire a more versatile and accurate measuring unit than a simple power level indicator, there are now available complete measuring sets which are built around a copper oxide A. C. voltmeter but which have a number of advantages over the less elaborate units.

One of these units which has recently been developed for the telephone field is shown in Figure 9. This unit consists of a very sensitive A. C. meter having a frequency range of from 50 to 30,000 cycles and a basic sensitivity of −15 decibels.

By means of jacks, keys and pads the meters can be used to read the level on either input or output circuits and to control both the sending and receiving levels. The unit is designed to work with an oscillator of 600 ohms impedance. The instrument is sufficiently accurate and the scale readings spread out that losses as low as 0.1 db can readily be measured.

"Defense Bonds" New Telephone Query

W. R. Journey, manager of the Citizens Telephone Company in Higginsville, Corder, and Mayview, Mo., announced recently that beginning Friday, June 27th, the central operators in all three towns would greet patrons with the words "Defense Bonds" instead of the customary "Number, Please."

This suggestion from the Treasury Department of the United States is part of a national drive to make the people of the country defense conscious, so they will contribute to the national welfare by purchasing the new national defense bonds and stamps, which went on sale May 1st.

Three Nebraska Telephone Employees Given Vail Awards For Noteworthy Public Service

For outstanding public service by telephone employees in 1940, two Nebraska telephone operators, Mrs. Nellie Lazure and Mrs. Mildred Lothrop, have been awarded gold medals and $1,000 each by the National Committee of Award, Theodore N. Vail Medals, for heroism and devotion to public service during the devastating flood at Winnebago and Homer, on the night of June 3-4, 1940.

Mrs. Lazure, who at the time of the flood was agent-operator at Winnebago for the Northeastern Telephone Company (E. C. Hunt property,) remained at the switchboard, keeping informed of the progress of the flood and warning inhabitants of their impending danger as it menaced the town. Although urged to leave, she remained on duty, sounding the village siren which is operated from the central office, and continuing to call on every line until all were rendered useless about 1 a. m. by the waters rising in the central office. Mrs. Lazure and two neighbors who had come into the building were then unable to escape through the flood waters and floating debris.

The rushing water rose to within two and one-half feet of the ceiling in the room in which the switchboard was located, and finally moved the building off its foundation against some nearby trees. Part of the building collapsed and the whole building seemed to be on the verge of breaking to pieces. She and her neighbors climbed on top of the switchboard and furniture, where they remained until 7:30 a. m. when a rescue party was able to get a rope across the flood waters to the house and thus to remove her and the others to safety. Her loyalty to the traditions of service resulted in the saving of lives.

During its annual convention at Lincoln on April 9, this year, the Nebraska Telephone Association presented to Mrs. Lazure a Certificate of Valor in recognition of loyal and heroic service.

Mrs. Lothrop, agency chief operator for the Northwestern Bell Telephone Company at Homer, although fully cognizant of the personal risk involved, remained at her switchboard to warn inhabitants of their impending danger from flood water and directed the work of rescuing those who she had learned were trapped by the rising water. She stayed at her post many hours until the flood receded, despite the rushing waters, which threatened the building and almost reached the second floor, where the switchboard was located.

Convention Dates

Michigan Independent Telephone Association, Hotel Olds, Lansing, July 23 and 24. Golf day, July 22.

Three-state joint meetings of Maine, New Hampshire and Vermont Telephone Associations, Mount Washington Hotel, Bretton Woods, N. H., September 9, 10 and 11.

Arkansas Telephone Association, Arlington Hotel, Hot Springs September 22 and 23.

Association of American Railroads, Telephone Section, Hotel Gibson, Cincinnati, Ohio, September 23, 24 and 25.

South Dakota Telephone Association, Hotel Carpenter, Sioux Falls, October 8 and 9.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 14, 15, 16 and 17.

Independent Pioneer Telephone Association, Hotel Stevens, Chicago, October 16.

Virginia Independent Telephone Association, Hotel Roanoke, Roanoke, October 23 and 24.

North Carolina Independent Telephone Association, Pine Needles Inn, Southern Pines, October 27 and 28.

South Carolina Independent Telephone Association, November 3 and 4.

Florida Telephone Association New Florida Hotel, Lakeland, November 7 and 8.

Alabama Independent Telephone Association, November 13 and 14.

Tennessee Independent Telephone Association, Hermitage Hotel, Nashville, November 17 and 18.

Kentucky Independent Telephone Association, December 2 and 3.

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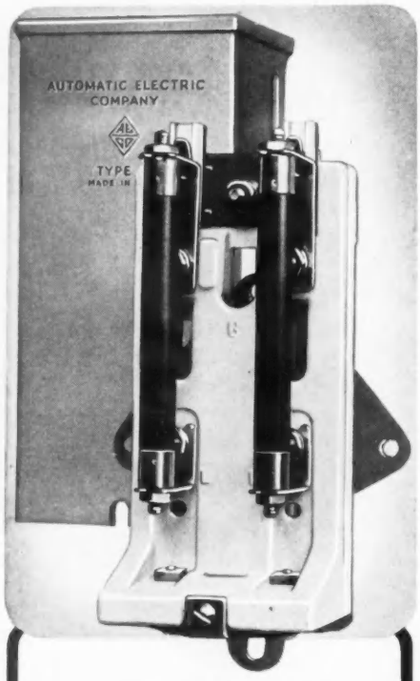

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Cable Fault Location With Wheatstone Bridge

(Continued from page 23)

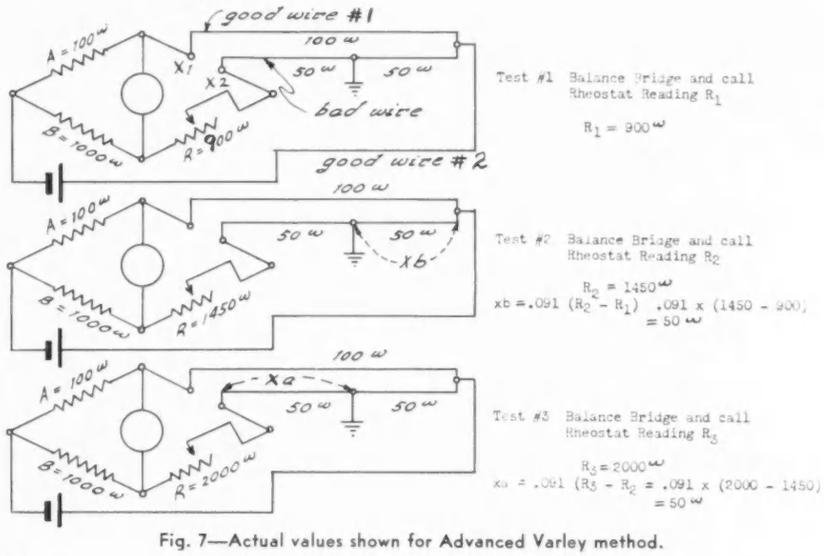

Fig. 7—Actual values shown for Advanced Varley method.

This method in addition to permitting the use of good and bad wires of different resistance, also results in greater accuracy as the use of a ratio dial setting of 0.1 enables readings to be taken to a tenth of an ohm.

The only disadvantage of this latter method is that it requires two wires instead of one. Figure 7 shows the connections for the advanced Varley method, and the readings and computations for a typical fault. Caution: Readings R_1 and R_2 are the rheostat settings and must not be multiplied by the ratio dial setting.

Conversion of Resistance to Fault into Distance

IN addition to a good understanding of how to use the Bridge in the location of cable on open wire faults, the tester must know how to convert readings in ohms into distance feet.

There are two ways in which this can be done, viz:

1. By merely multiplying feet per ohm factor by resistance from strap to fault
2. By determining the true feet per ohm factor and then multiplying as above.

The feet per ohm for various gauge copper conductors varies with temperature. The higher the temperature the higher the resistance of a given length of copper wire, hence, the fewer feet per ohm.

In dealing with U. G. cable where great precision is required, the actual temperature in the duct run should be used.

Where a high degree of accuracy in locating a fault is desired and where only one gauge of conductor is involved in the tested section, a true feet per ohm value should be used. This is obtained by measuring the bad wire resistance and length and dividing the length by the resistance to give true feet per ohm, i.e.,

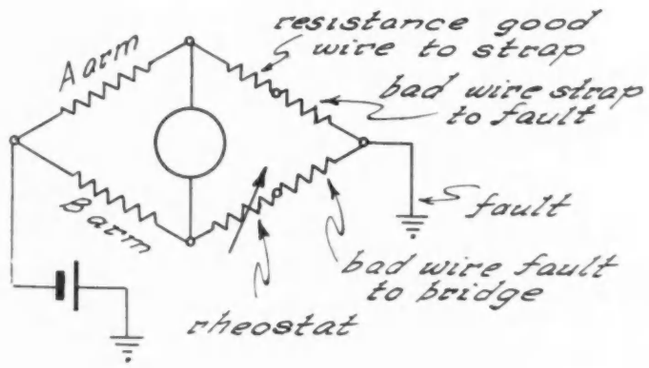

Fig. 6 — Disposition of resistances in Simple Varley Method.

$$\text{True ft. per ohm} = \frac{\text{Bad wire length}}{\text{Bad wire resistance}}$$

Bridge Limitations

THERE are two limitations that should be kept in mind in using the Wheatstone Bridge, viz:

1. Fault resistance—Theoretically the actual resistance of the fault does not affect the accuracy of the reading obtained. However, the higher the fault resistance the less current is available to operate the galvanometer and the greater the difficulty of determining the exact balance point on the Bridge. In general if the fault resistance does not exceed 100,000 ohms, it is possible to locate faults with a high degree of accuracy. Faults as high as 500,000 ohms can be computed sufficiently close to permit easy location in aerial cable where sheath break trouble is involved.

4½ volts of battery is adequate on faults up to 10,000 ohms. Above 10,000 ohms 45-90 volts should be used.

2. Good Wire Leakage—Where the good wire or wires used are not free from leakage to ground, precision measurements cannot be obtained. In the location of a wet cable fault, it often happens that every pair in the cable may show some leakage. In such cases and where it is not desired to use good wires "strung in" from some nearby cable, wires which show considerable leakage can be utilized and fairly good results obtained provided the ratio of good to bad wire leakage resistance is at least one to fifty. In other words, the bad wire should show at least 50 times more leakage than the good wire. Under this circumstance the error due to failure to have a perfect good wire will not ordinarily be more than a few hundred feet. On long aerial cables being able to isolate a sheath break to a few hundred feet of cable is of great help, as a visual inspection of the sheath for several spans each side of the computed location will usually enable a quick location of the sheath opening.

North Dakota Association Has Spirited Meeting

ENTHUSIASM was the prevailing note when the 35th annual convention of the North Dakota Telephone Association got under way in Minot, June 11th, and continued through the two day session.

The registration was somewhat ahead of last year and a keen interest was manifested during the entire two days. Crop conditions throughout the State are ideal and with business conditions improved over the last few years, the telephone people generally, were in high spirits.

All officers were re-elected, namely: W. R. Williams, President—Minot; A. R. Brooks, V. President—Hazen, and A. J. McInnes, Secy.-Treas.—Fargo.

The three directors whose terms expire were all re-elected, as follows: F. W. Vail—Milnor; G. B. Brown—Enderlin, and A. R. Brooks—Hazen.

The other six directors being holdovers.

Exhibits were housed in a large room adjoining the sessions room, which is a departure from the traditional hotel rooms. This arrangement worked out very satisfactory to all concerned; the exhibitors being kept busy showing their wares to the delegates and visitors, before the session opened in the morning, during recess, and after the sessions closed. The telephone people were much interested in the exhibits of various dial units and other modern equipment.

There were a number of speakers on the program. The convention was called to order by President Williams and the guests were welcomed by Doctor Sandberg, mayor of Minot. Louis Pitcher of Chicago, executive vice president of the United States Independent Telephone Association, spoke on "The National Situation." L. A. Hill of Minneapolis, regional director of the wage and hour division, U. S. Department of Labor, discussed the wage and hour law. "Education and Life in North Dakota" was discussed by C. C. Swain, president of the State Teachers' college in Minot. Archie O'Connor, North Dakota director of safety, spoke on the "North Dakota Highway Patrol." C. W. McDonnell of Bismarck, member of the state public service commission, spoke about regulatory matters. Harold R. Weber, Northwestern Bell district manager at Fargo, presented a legislative report, and M. W. Ricker of the Northwestern Bell Company at Fargo, gave a lecture-demonstration, "Science Behind Your Telephone."

A feature of the convention was a banquet, entertainment and dance at the beautiful Minot Country club, which is several miles out of the city. More than 120 persons attended and had a good time.

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ROEBLING makes available a wide variety of electrical wires and cables to meet practically every telephone and telegraph need. In addition to those shown, Roebling makes:—Parallel Telephone Wire ...Rubber Insulated and Braided, Bare Copper and Bronze Wire, Bare Galvanized Steel Wire, Galvanized Steel Strand.

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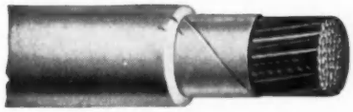

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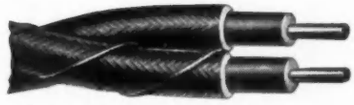

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Illustrated above is Seymour Smith hand pruning saw No. 826. It is one of a complete line of fast cutting, accurate saws designed for pruning and clearing.
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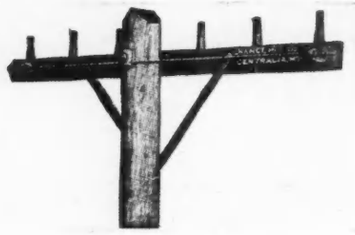

Fig. 5—Use of Back Brace to strengthen Dead End Arm.

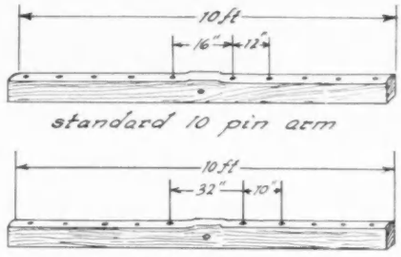

Fig. 8—Detail of Standard and Special Joint Use Arms.

Wire Chief's Course

(Continued from page 25)

the pole and approximately 3/8 inches deep and cut slightly concave so that the arm will pull up snugly, and not rock in the gain.

A 11/16th inch hole should be drilled at the center of the gain for the 5/8th inch crossarm bolt. The hole can be centered as shown in Fig. 2. The width of the gain will depend on the type crossarm used but in general should be 4¼ inches for standard arms and 3¾ inches for pony arms.

Crossarms

ALTHO crossarms are available in 2,4,6,8, and 10 pin sizes, it is customary to use mainly 6 and 10 pin arms. For leads of only 2 or 4 wires brackets are generally used. Some companies use 2 and 4 pin arms in order to utilize shorter poles than would be possible if brackets were used. Crossarms are available in two sizes known as **pony** and **standard**. Pony arms are 2¾" x 3¾" while standard arms are 3¼" x 4¼". The larger companies generally specify the standard arms (in ten pin size) particularly on toll lines, while the small companies seem to prefer the Pony arm because of its lower cost.

The material requirements for a standard ten pin crossarm lead is shown by Fig. 3.

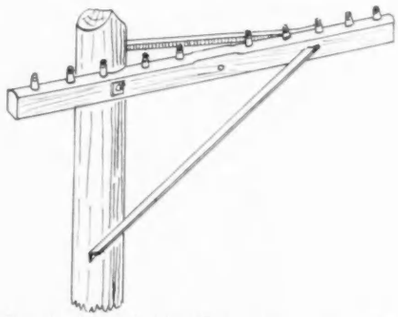

Fig. 9—Use of Alley Type Arm to provide Tree Clearance.

Double Arming

AT dead end and corner poles in crossarm leads, it is necessary to provide additional strength for wire support. This can be accomplished either by **double arming** or by the use of a **back brace**. The two methods are illustrated in Fig. 4 and 5.

The double arming method will in general provide the greatest strength and is preferred particularly at dead ends.

Special Arms for Joint Use

THE National Electric Safety Rules prescribe that a clear climbing space 30 inches be provided on joint use poles when the voltage of the supply conductors carried does not exceed 7500 volts, and 36 inches where, the supply line voltage is between 7500 and 15,000 volts. Inasmuch as most joint use is at voltages of 7500 and less we are primarily concerned with furnishing 30 inches clearance.

The ordinary ten pin arm provides only 16 inch climbing space, hence should

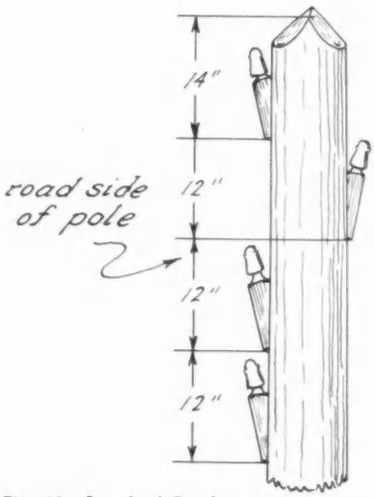

Fig. 10—Standard Bracket Arrangement.

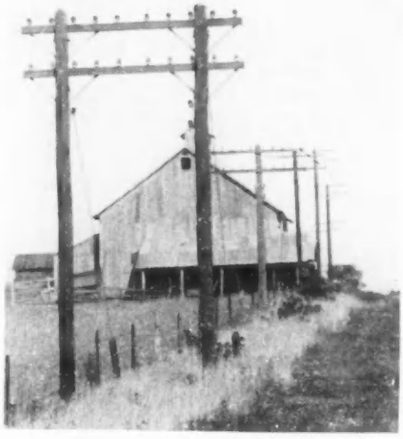

Fig. 15—"H" Type Storm Fixture.

not be used on joint poles. Special ten pin arms are available which will provide the necessay climbing space and these should be used on joint leads which carry open wire. The spacing of a standard and a special joint use arm is shown in Fig. 8.

Use of Alley Arms

WHERE poles are set close to buildings and other obstructions, or where it is necessary to offset a crossarm in order to clear trees that cannot be trimmed, alley arms should be used. These are ordinary arms which are offset from the pole by means of a special diagonal brace and a back brace arranged as shown in Figure 9. If properly constructed alley arms are quite sturdy and oftentimes provide a successful solution to a difficult clearance problem.

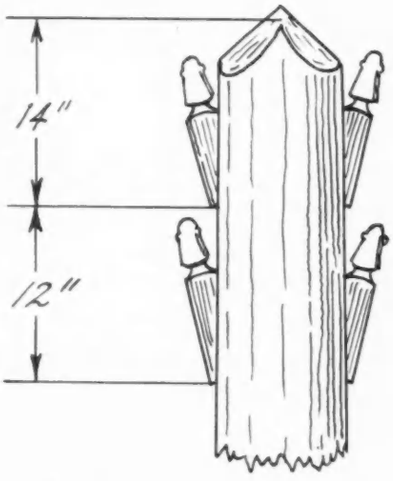

Fig. 11 — Position of Brackets to Give Greater clearance above Ground.

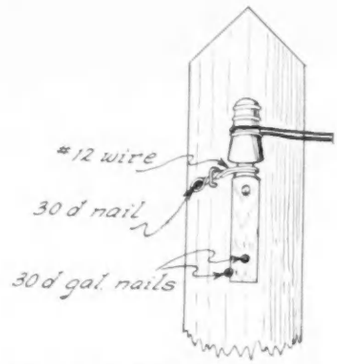

Fig. 12—Method of Strengthening Dead Ends.

MINOR leads which carry not to exceed four wires can economically employ brackets. Where poles are of adequate height and it becomes necessary to add two additional wires to an existing four wire bracket line, it is permissible to place the wires on brackets rather than to go to a six pin arm. In most situations however it will be necessary to remove old brackets and place an arm when more than four wires are needed.

The standard bracket arrangement is shown in Fig. 10. In order to gain additional clearance at road crossings, brackets may be arranged as shown in Fig. 11 Where the spans are not too

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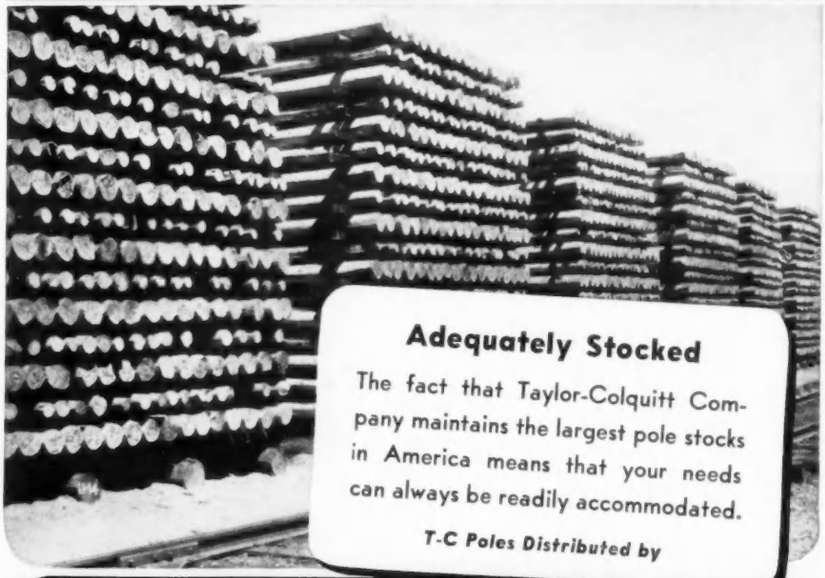

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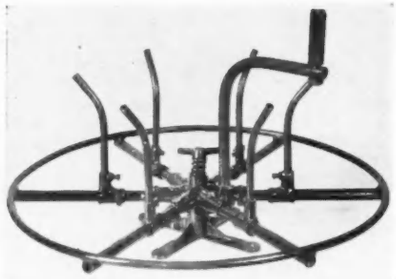

Easy to Put On or Take Off Trucks

One handy feature of the 4AT Ready wire reel for truck mounting is the ease of removing the reel if not needed. The base has four holes for permanent mounting on the truck. The spindle is about 12 inches high.

If reel is not needed, you simply screw off the wing lock nut and lift the reel off the spindle. Then slip a wood cover over the spindle bolt to keep it from damage and the truck is practically clear.

This reel is adjustable for coils from 14 to 27 inches inside dimension. Adjustable payout tension. All metal. The 4AT model costs only $12.60.

See catalog for other models.

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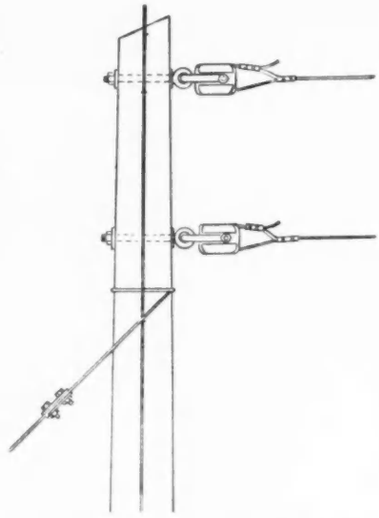

Fig. 13—Use of Strain Insulators for Dead Ending Long Spans. (Courtesy Indiana Steel & Wire Co.)

long, some companies prefer the bracket arrangement shown in Fig. 11 to that of Fig. 10.

At dead end points brackets should be strengthened by means of a length of No. 109 iron wire wrapped around the bracket below the pin and fastened to the pole with a 30 d nail as shown in Fig. 12—A. Iron brackets which fit over wood brackets are now available and are preferable to the wire rope method. The use of iron brackets is shown in Fig. 12—b.

On the exceptionally long spans which are now possible with the new high tensile strength wire, an extra heavy dead end support is desired and for this purpose porcelain strain insulators and a clevis assembly as shown in Fig. 13 is being used. An alternate method using a heavy iron bracket which is fastened with a through bolt and lag is shown in Fig. 14.

Special Storm Fixtures

IN sections of line located in a particularly exposed section of country use is often made of **H fixtures** which are placed at periodic intervals in the line and which tend to prevent a long length of pole going down should one section fail. When a multi-wire lead is heavily loaded with sleet and wind the failure of a single pole often results in a large section of line going down due to the stress placed on adjacent poles by the failure of a single pole. The H frame structures tend to stop the "toppling line" and are usually placed at intervals of from 1/6 to ¼ mile when used. Fig. 15 shows H fixture construction.

(END)

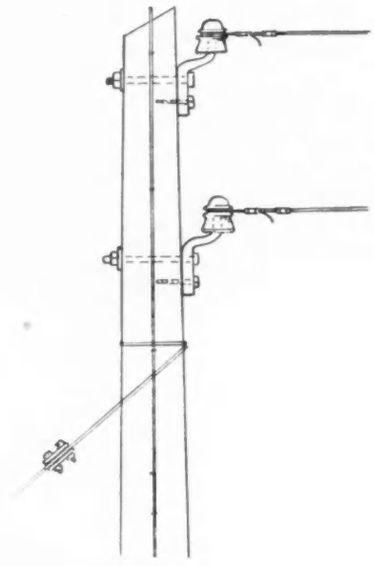

Fig. 14—Use of Heavy Brackets for Dead Ending Long Spans. (Courtesy Indiana Steel & Wire Co.)

Arkansas Convention On September 22nd and 23rd

President S. A. Lane cordially invites all telephone people to attend the convention of the Arkansas Telephone Association to be held on September 22nd and 23rd at the Arlington Hotel, Hot Springs, Arkansas. He promises an interesting and varied program.

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WIRE CHIEF'S EXAMINATION—NO. V

Pole Line Fixtures

1. Explain what the terms FRAMING and GAINING cover.
2. What is the purpose of a GAIN?
3. What is the basic difference between PONY and STANDARD ARMS?
4. How much climbing space is required on a joint use pole which carries a 6600 volt power circuit?
5. Why are special telephone crossarms needed on poles which carry both power and telephone wires?
6. What is the maximum number of brackets that should be employed in new construction? In old construction?
7. Are ordinary brackets suitable for dead ends where high tensile strength wire is used in long span construction?
8. What method can be used to strengthen an ordinary bracket at a dead end point?
9. What is considered standard vertical spacing between crossarms?
10. Why are H fixtures used at periodic intervals in some lines?

J. W. HUBBELL, President New York Telephone Co.

J. W. Hubbell Named as President N. Y. Telephone Co.

James L. Kilpatrick, president of the New York Telephone Company since 1933 will retire on July 31, 1941, in accordance with the Company's retirement plan, and will be succeeded by James W. Hubbell, vice president in charge of operations for the company, it was announced June 25 following a meeting of the board of directors.

Carl Whitmore, vice president (Personnel) of the company, was designated vice president in charge of operations. Oscar M. Taylor, assistant vice president of the personnel relations department, American Telephone and Telegraph Company, was appointed vice president (Personnel) to succeed Mr. Whitmore.

Mr. Hubbell entered the service of the New York Telephone Company in 1902 as a clerk in the Brooklyn Traffic Department. He was made Assistant Traffic Manager, and shortly afterward, Traffic Manager, in the South Brooklyn, Williamsburg, Main and Newark districts. In 1914 he went to the Bell Telephone Company of Pennsylvania as Traffic Engineer, where, in 1917, he became Engineer of Equipment and Buildings.

During that year Mr. Hubbell, commissioned as a Major in the Officer's Signal Reserve Corps, organized the First Reserve Telephone Battalion at Philadelphia, and was sent overseas. He took part in the Champagne-Marne Defensive and the Marne-Aisne Offensive, was promoted to the rank of Lieutenant-Colonel, and returned to this country as Division Signal Officer, 16th Division.

In 1919 he was called from Pennsylvania and made Traffic Engineer of the New York Telephone Company, and in 1921, General Traffic Engineer. He was appointed Chief Engineer, Upstate, in July 1925, General Manager in 1926, and Vice President and General Manager, Upstate, in September 1927. On September 26, 1934, Mr. Hubbell was appointed a Director of the New York Telephone Company, and on October 1, 1934, was appointed Vice President (Operation). He is a member of the Executive Committee.

Oscar M. Taylor, Vice - President Personnel.

Carl Whitmore, Vice-President Operation.

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The real holding power of an anchor cannot be definitely determined immediately after installation. Time tests tell the true story and definitely prove the superiority of Never Creep Anchors. Moisture penetration has little effect on the holding power of the Never Creep because it bolts through solid, undisturbed earth. Compare the time and effort required to install the Never Creep to that required for any other type anchor, add to this time and labor saving feature, the value of the extra holding power obtained and you'll use Never Creeps wherever possible.

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IN CANADA:

Canadian Telephones & Supplies, Limited
Northern Electric Co., Limited

the **GRAY MFG. CO.**

Personals from the Field

Jules Saunders and **Glen Bosworth** of the Associated Telephone Co., Ltd., Santa Monica, are the two camera-hounds that furnished us pictures of the recent California convention. From our experience with professional photographers for convention pictures we think Jules and Glen have more than "something" on the ball.

▼

Jeff Book, wire chief of the Malden exchange of the Southwest Missouri Telephone Co., celebrated 30 years of active service on June 1. He is very definite in his statements that he has enjoyed every year of it and expects a few more before retirement.

▼

Roland C. Davies, our Washington correspondent which you read in each issue of TELEPHONE ENGINEER, recently visited Fort Monmouth where the Signal Corps have their school. We are always surprised to hear of Roland out of Washington as we cannot see how he has time to get all his news without being on the job night and day.

▼

Louis Pitcher, executive vice president of the USITA, has just returned from his first vacation since being appointed by the Association over 4 years ago. He and Mrs. Pitcher took a few days off after the recent West Coast conventions to take a short trip to Alaska.

▼

Arthur F. Oldham is now publicity manager and Gordon J. Buchanan is editor of the Telephone Bulletin of the Cincinnati & Suburban Bell. They succeed Myron L. Smith, retired.

▼

Frank L. McKinney, secretary-treasurer of the Ohio Independent Telephone Association, has received many congratulatory messages complimenting officers and directors of the Association upon the recent Statistical Survey and Comprehensive Study that was mailed to all members last month. The Survey has 168 pages and is a good job, well done.

F. O. Cuppy, Lafayette, Ind., has been made president of the Indiana Associated Telephone Company. He succeeds J. F. O'Connell who was made Chairman of the Board of the company.

F. O. Cuppy, Lafayette, Ind.

▼

George H. Gray, 50, wire chief for the Illinois Allied Telephone Co. at Princeton, died recently as the result of heart attack suffered while playing golf. He had been employed by his company for the past 27 years.

▼

Harry H. Bates, manager of the Dixon (Ill.) Home Telephone Co., has invited the Illinois Telephone Association to hold one of its district meetings in Dixon this year. Dates for the District Meetings have not been set.

▼

A. J. McInnes, secretary of the North Dakota Association, was roundly applauded for the excellent convention held in Minot last month. He authored the report, a portion of which, appears in this issue.

▼

Milo Caslasky, with 36½ years, and **Royal S. Brewster** with 36 years are the ranking employees of the Lincoln (Nebr.) Tel. & Tel. Co. **Milo** was presented with a gold button for his ranking at the recent organization of the Frank H. Woods Chapter of the Independent Pioneers.

Statement of USITA'S Brorein Issued on Toll Rate Reduction

The executive committee of the United States Independent Telephone Association met in Chicago on July 1. Following this meeting, at which the recent reduction in interstate toll rates of the American Telephone and Telegraph Co. was discussed, President Brorein of the USITA issued a statement concerning the association's position in connection with the toll reduction. We reproduce this statement below:

"At the Spring Conference of the United States Independent Telephone Association, a resolution was adopted stating generally the position of the Association with reference to compensation on interchange tolls with the American Tel. & Tel. Co. and Bell subsidiaries. This resolution stated that the Independent companies' costs, both direct and indirect, in connection with the handling of interchanged toll business, in addition to a fair compensation for the rendition of service and reasonable return upon the property used, should provide the basis for the compensation to be paid to connecting companies; and further, pending the determination of such compensation that no reduction of the amount now being paid to any Independent company for handling Bell toll business should be made by the Bell System in the event of any reduction of toll rates.

"Following the adoption of this resolution by the Association, and with it as a basis, the Executive Committee at a preliminary meeting with representatives of the American Company discussed the manner in which they might be carried out.

"No agreement was reached at this meeting, but the Toll Compensation Committee of the Association was instructed to proceed with its studies and their presentation to the American Company, with the purpose of showing that the present standard compensation arrangements are in general not conforming to the provisions of the resolution because of their inadequacy.

"Pursuant to these instructions, the Toll Compensation Committee has already presented certain studies and data to the American Company which indicate the correctness of the Association's position.

"Following the meeting also, an agreement was made by the American Company with the F.C.C. to accept certain toll rate reductions, and the statement issued by the F.C.C. requires that the American Company 'assume all reductions in revenue brought about by these reductions in interstate schedules in which long lines is a participating carrier and that arrangements should be made with associated companies and Independent connecting companies so that these reductions would not affect the revenues of either of the latter two groups.'"

"While neither the Independent Association nor any of its member companies were parties to this agreement or the rate proceedings which preceded it, the Association nevertheless feels gratified that its position was recognized by the F.C.C. and accepted by the American Company, and it expressed its appreciation to the Commission through its officers, and also communicated with President Gifford of the American Tel. & Tel. Co., recognizing the Federal Communication Commission's release as it affected the compensation to the connecting companies and requesting information as to the steps the American Company might be taking, or expected to take, in arranging to carry out the intention of the F.C.C. order. The cooperation of the Association insofar as it would be useful or practical in carrying out this program was also offered.

"In reply to this communication, the American Company advised that the preparation of new tariffs and the placing in the hands of the operating forces of the rate revisions and practices by the 10th of July, the effective date, was so great that it would be impossible for the

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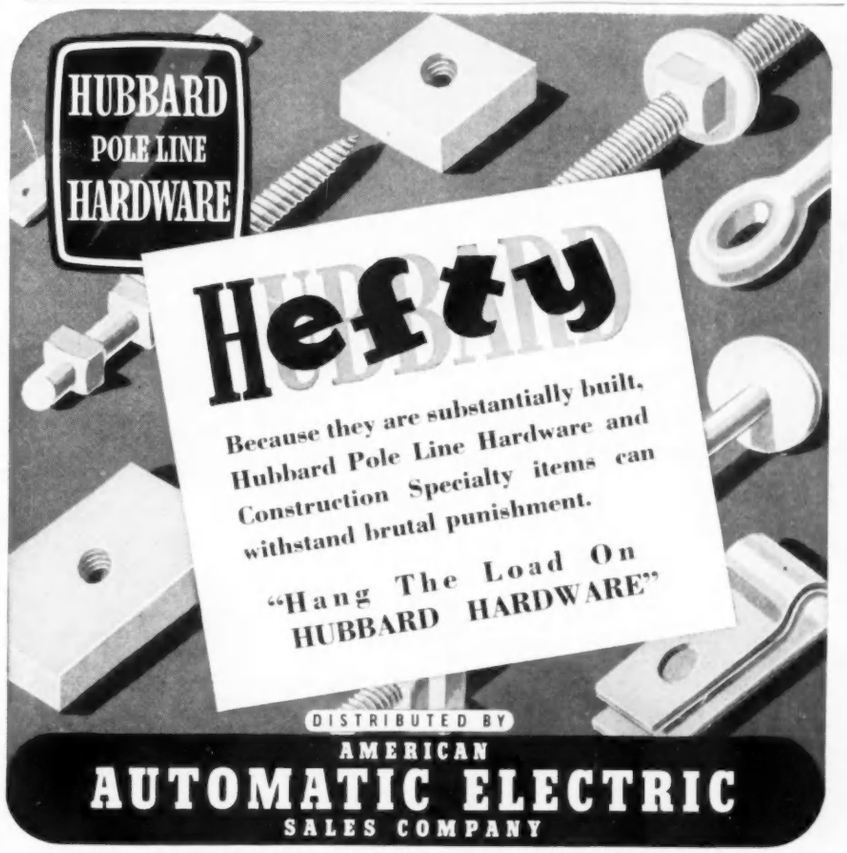

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American Company to work out the necessary provisions before July 10th, but that all of the Bell Companies expected to give consideration to this matter sometime after this date.

"The Association, of course, expects that the American Company and the Bell affiliates will develop and submit their proposals to carry through the requirements of the F.C.C. order as it affects the compensation to the Independents at as early a date as possible, to be made effective on July 10, the date the revised toll rates ordered by the F.C.C. go into effect. In the meantime, the Toll Compensation Committee is continuing to work on the preparation and submission of data which will set forth the position that has been taken with reference to additional compensation for interchanged toll business. It is not to be expected that the Association can do more than present a general picture because of varying conditions that affect individual companies, both Independent and Bell. It is the purpose of the Association to develop the fundamental ground work which will enable its members to better present their individual cases and to assist the members in so far as possible, in the preparation of such a presentation.

"The Association expects to be informed with reference to the plan or proposals which the American Tel. & Tel. Co. and Bell groups will make to their connecting companies in order that the F.C.C.'s provision with reference to compensation, as stated above, can be carried out."

South Americans Inspect Indiana Exchange

Dr. Jose de la Vega and Dr. Samuel Antonio Rueda, of Bogota, capitol of the Colombian Republic, were in Fort Wayne, Ind. last month to inspect the property and operation of the Home Telephone and Telegraph Company.

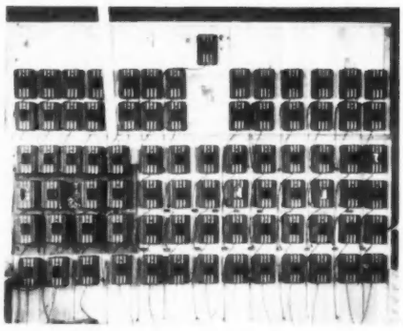
Dr. de la Verga, a senator of the Republic, owner of an important newspaper in Bogota and an official of the city government and Dr. Rueda, a leading physician in the state, a former mayor of Bogota and president of a surgical college there, are considering entering the telephone business in Bogota.

"I wore this dress, we drank scotch, and then we sat on the love seat—and he told me all about the TELEPHONE business."

Off THE ASSEMBLY LINE

Telerings Aid In Defense

Pictured is a display of a small portion of TeleRings recently shipped by Telkor, Inc., Elyria, Ohio, on a government order of over 400 instruments. Their recently developed "Tele-Spot" is behind in deliveries due to the unusual demand made by the government on delivery of their other product but the company hopes to catch up as quickly as possible.



A few of the several hundred TeleRings just delivered to the Signal Corps.

To Make "Assault" Wire for Signal Corps

Bristol, R. I., June 23, 1941—"Assault wire" for the Army—multiple thousands of miles of military telephone wire—is to be manufactured in this little Rhode Island industrial town, it was announced here today by United States Rubber Company. Involved also is the reconstruction and re-equipment of a currently idle factory here in order to manufacture the vast order.

The announcement here followed recent word from Washington that the United States Government's Defense Plant Corporation and the Army Signal Corps had entered into agreements with United States Rubber Company for both the plant and the wire. It was estimated that more than $3,143,000 worth of this combat type of wire is involved, and more than $700,000 is to be invested in reconstructing and re-equipping the building to be used.

The new type wire weighs between 28 and 29 pounds per mile—as compared with the old type used by the Army, which weighed about 160 pounds to the mile. Since "Assault wire" is the type of field telephone wire commonly carried in reels on the backs of soldiers as they advance in combat, unreeling it as they run in the advance, the weight-saving represents an enormous advantage.

Selenium Use Increased

Another of the interesting sidelights of the National Defense Program is the fabulous increase in the refinement of pure selenium in the United States which, according to George Lewis, Vice President of International Telephone and Radio Manufacturing Corp., has increased one hundred fold this year over last.

Selenium is one of the lesser known of the physical elements but is employed in the manufacture of red glass, certain pharmaceutical products and now in the I.T.T. Selenium Rectifiers which are being used extensively by various National Defense suppliers. The applica-

No. 3

UNIQUE BLOW TORCHES

are made for your *particular* work!

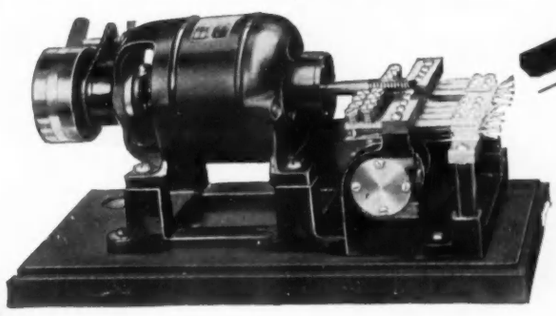
These features guarantee satisfaction . . .

- **FLAME 7" x 1"—2000° F—QUICK STARTING IN ANY WEATHER** because of long forward fuel veins and full skirted shield.
- **FINE FLAME CONTROL—AUTOMATIC ORIFICE CLEANING** because of slender steel needle in end of stem.
- **LONG LIFE GENERATOR—EASY TO CLEAN** — heat-resisting casting doesn't scale — fuel veins are straight; fitted with removable plugs.
- **LONG LIFE TANK—EASY TO FILL**— 18 gauge steel with welded fittings and bottom funnel filler.
- **COMFORTABLE TO USE**—angular tank handle; cool bakelite valve wheel.

Try this Unique torch for 30 days on your own work—you'll like it!

Write for Bulletin 40—describes other Unique splicer's tools and accessories.

UNIQUE MANUFACTURING CO., INC.
231 W. Walton St. — Chicago, Ill.



HOLTZER-CABOT
MOTOR-DRIVEN INTERRUPTER

Holtzer-Cabot complete motor driven interrupter equipment combines a method of producing good signaling tones with a means for automatic ringing. Holtzer-Cabot interrupter equipment will:

1. Eliminate slow acting relays.
2. Reduce maintenance.
3. Give positive timing.

AND

4. Is SIMPLE AND DEPENDABLE.

Write for Bulletin 1310-02

125 Amory St. BOSTON, MASS. *Motor Specialists* **6161 S. State St. CHICAGO, ILL.**

The Clearing House

For the convenience of readers of Telephone Engineer

Transmitter Repairs

Specialists in Repairing and Rebuilding Transmitters

OUTSIDE IRON POLICE BOXES

—with Kellogg C.B. Straight Line Telephone ..... *Complete*—$14.00

We buy and trade Used Telephones and Parts

Write us for Quotations

Telephone Repair Co.

Daniel H. McNulty, Manager
Rogers Park Station Chicago

LOOMIS ADVERTISING CO.

A SALES ORGANIZATION *exclusively..*

That Has Never Failed to Produce More Net Revenue (All Costs Considered) for Telephone Companies Served.

IF INTERESTED in more net telephone directory revenue write or call at our expense.

LOOMIS ADVERTISING CO.

Telephone Bldg., Kansas City, Mo.

Citizens Trust Bldg., Fort Wayne, Ind. 135 So. Second St., Philadelphia, Pa.

How to —

Wipe Perfect Joints

on lead-sheathed cable splices.

A post card for free instructions

GEO. E. WILLIAMS, Mfr.

Aldrich Ave. Minneapolis, Minn.

tion of Selenium in rectifiers was developed by a subsidiary of the International Telephone and Telegraph Corporation in Europe and, Mr. Lewis says, that an impression has existed that selenium is a European material. The fact is, he points out, that practically all of the world's supply is obtained in the United States and Canada.

Leich Sales Corporation Names Ohio Salesman

Announcement recently mailed to Ohio telephone companies carried the news of the appointment of Bill Mossman as the Ohio representative of Leich Sales Corporation, Chicago.

Bill Mossman

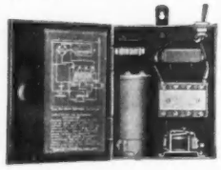
Prior to joining the Leich organization, Mr. Mossman had been engaged in technical research on relays and other electrical specialties employed in communication work. His entire business career has been closely affiliated with the telephone industry.

After leaving Northeastern University in 1934, Mr. Mossman joined a telephone manufacturing organization in the New England territory. In 1936, he accepted a position with the State of Pennsylvania and in this work he came in close contact with many of the Pennsylvania telephone men. Subsequently, he became engaged in development work on relays and other circuit control devices in Chicago.

To serve Leich's Ohio customers, Mr. Mossman will make his home in Kenton, Ohio.

THE NEW ELECTROX

Battery Eliminator Type PA-05004



$16.85

Complete with power-off relay. Output for two operators' sets. Mount; connect two leads to operator's terminal; plug in cord. Presto! no more battery problem! Sent on trial. Write for Cir. 373.

ELECTROX 2060-68 Reading Road
A Schauer Product CINCINNATI, OHIO

Telephone Engineers

J. G. WRAY & CO.

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Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies

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CONSULTING ENGINEER

Telephone Engineering — Construction Supervision — Appraisals — Financial — Rate Investigations

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Cedar Poles

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CEDAR POLES

Plain or Butt Treated
B. J. CARNEY & CO.
100 No. 7th St. Minneapolis

Finished Cedar Poles
VALENTINE CLARK CORPORATION
St. Paul, Minn.

Telephone Directories

Telephone Directory ADVERTISING

Write or telephone for proposition

L.M.BERRY & CO.

Call L.D. 16, Telephone Bldg., Dayton, O.

The Clearing House

For the convenience of readers of Telephone Engineer

Guy A. Barker Dies

Guy A. Barker, manager of the public utility and electrical products departments of Johns-Manville, died June 18 soon after he suffered a heart attack at his home in Scarsdale, N. Y. He was 50 years old.

Mr. Barker started his career with Johns-Manville as a sales engineer, later serving as a Pacific Division sales manager and a Chicago district sales manager, before coming to New York in 1933 to become manager of the electrical products department. He was made manager of the company's public utility and electrical departments in April of this year.

Gummed Stickers for Wire Identification

A NEW adhesive product that should prove exceptionally useful in the telephone field has recently been made available by the Avery Adhesive Co., 1220 Board of Trade Bldg., of Chicago.

This item consists of paper strip labels ½" x 1¾" long with one side coated with adhesive. The strips come mounted on glassine and are easily removed and can be placed around wires, on terminal strips, and wherever a neat and readily applied identification marker is needed. Being mounted two abreast on a roll of glassine paper, they can be placed in a typewriter where neat, uniform designations are required.

This new product should find wide acceptance in the telephone field as it has real merit and is something for which there is real need.

Norman M. Shenk Joins Cook Electric

Mr. Norman M. Shenk, Newton, Iowa, has resigned as general manager of the State Telephone Company and general commercial superintendent of Investors Telephone System, to join the staff of Cook Electric Company on July 16th.

Prior to his association at Newton, Mr. Shenk served as vice president and general manager of the Central Carolina Telephone Company, Southern Pines, N. Carolina, and was secretary of the North Carolina Independent Telephone Association. Before going to Southern Pines he was also commercial superintendent of the Jamestown Telephone Corporation of Jamestown, New York. Earlier he served as district commercial manager of the Pennsylvania Telephone Corporation at Erie, Pennsylvania, and later at Long Beach, California.

Mr. Shenk is a graduate of the University of Pittsburgh. He will make his residence at Evanston, Illinois, and will be headquartered at the Cook Electric Company general offices in Chicago.

Reconstructed Equipment

Kellogg No. 79 Central Battery Ind. Coils @	$ 0.45
Western Elec. No. 20 Central Battery Ind. Coil 35c; No. 46 @	.50
Kellogg No. 2800 type 4-bar 1000-1600 ohm compacts @	9.25
Kellogg No. 115 Hand sets with 3 Cond. cords @	4.50
Connecticut 3-bar 1000 ohm external post connection desk set signal set with Ind. Coil @	5.00
Auto. Elec. or Kellogg 500 ohm drops and jacks 10 per strip @	16.00
Stromberg Carlson No. 992 or 998 desk set with 3-bar 1000 ohm ringer enclosed connection signal set @	8.75
Stromberg Carlson No. 992 or 998 desk set with Connecticut 3-bar 1000 ohm ringer external post connection signal set @	8.00
Western Elec. No. 50 Latest type 3-bar Gen. with cranks & Mtg. screws @	2.75
Western Elec. 4 Cell Metal Battery boxes New @	.75
Kellogg Monarch or Dean 100 ohm drop coils @	.30
Western Elec. No. 534 Enclosed gong steel signal sets with Booster Coil Cond. and 1400 ohm ringers @	4.75
Kellogg No. 103 3 Spring Switch hooks complete @	.75
Kellogg No. 729 Straight line oak wood Central Battery hotel sets with Booster coil Cond. and 1000 ohm ringer @	6.75
15 Amp. Double Pole double throw knife switches @	.25
Western Elec. No. 143 Receiver with cord and Shell or Kellogg No. 41 @	1.25
Western Elec. No. 323 Transmitters less back @	1.00

REBUILT ELECTRIC EQUIPMENT CO.
1934 WEST 21st STREET
Pilsen Station
CHICAGO, ILL.

RECONDITIONED HOLTZER CABOT MOTOR GENERATOR SETS

Volts 110 — Watts 15

MOTOR—Single Phase
60 cycles A.C.
1150 R.P.M.

GENERATOR—80 volts
19 cycles
Single Phase

EXCELLENT CONDITION

Write for prices!

Buckeye Telephone & Supply Company
COLUMBUS, OHIO

TELERING
Only ONE Contact!
Price $44.00
F. O. B. factory

For better and cheaper ringing
No Radio Interference
30-day free trial
TELKOR, Inc.
ELYRIA, OHIO

Crapo
HIGH-TENSILE
LOW-RESISTANCE
TELEPHONE WIRE

Crapo HTL-85 — For Long Spans

Crapo HTL-135 — For Extra Long Spans

INDIANA STEEL & WIRE CO. MUNCIE, INDIANA U.S.A.

LOWER FIRST COSTS LESS MAINTENANCE

Construction costs are reduced to a new low level, maintenance expense is minimized, wherever *Crapo* HTL-85 and *Crapo* HTL-135 High-tensile, Low-resistance Line Wires are used. These revolutionary wires, with their superior strength, make possible rural lines with span lengths one and one-half to two and one-half times greater than were practical heretofore.

Crapo HTL-85 permits spans to 225 feet in heavy, 325 feet in medium, and 375 feet in light loading districts; provides stronger spans on existing pole structures.

Crapo HTL-135 makes possible spans of from 350 feet in heavy to 500 feet in light loading districts. Both wires possess superior telephonic transmission qualities.

Write for complete technical data and construction practice information!

INDIANA STEEL & WIRE CO.
MUNCIE, ◆ INDIANA

Manufacturers of
Crapo Galvanized Telephone Wire
Steel Strand, Tie Wire,
Construction Wire.

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NATIONAL NICOPRESS SLEEVES and TOOLS

No. 31-DC *Nicopress* Tool

Assure the Ideal Splice for LINE—DROP—BRIDLE and INSIDE WIRES

Nicopress Sleeve

Completed *Nicopress* Splice

No. 17-2 *Nicopress* Tool

You eliminate trouble when you make splices with NICOPRESS sleeves and tools. All line joints made with them exceed the rated breaking strength of the conductors and are so tight the conductors will not pull out. Nicopress splices have a high lasting conductivity. They are easily and quickly made either "in the air" or on the ground with the practical, convenient NICOPRESS tools.

For Drop—either parallel or twisted pair—Bridle or Inside wire splices, Nicopress Sleeves and the new Number "17-2" Nicopress Tools are unsurpassed. With these tools, easily operated with one hand, the splicing jobs are greatly simplified and the resultant splices are highly efficient. You'll find it pays both in saving of time and money to standardize on the Nicopress Method of splicing. Order from your jobber today.

Completed Drop Wire Splice

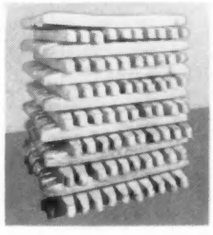
Nicopress Drop Wire Sleeve

THE NATIONAL TELEPHONE SUPPLY COMPANY

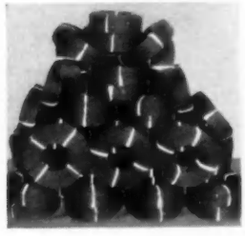
5100 SUPERIOR AVENUE - - CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



FROM COPPER BAR TO FINISHED WIRE



Under PHILLIPS' *Control!*

One of the main reasons for the consistently high quality of Phillips Wires and Cables, is that Phillips performs in its own modern plant all processes from copper bar to finished product.

The Phillips plant is now considered the most modern and comprehensive of its kind in the world. Its processes are based on long experience and modern research. To pass final inspection, Phillips products must meet the most rigorous tests.

No wonder engineers everywhere consider Phillips wire and cable tops in performance and long life! Every form of conductor required in telephone, communication and signal work can be supplied by Phillips. Write for prices—today!

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EXPORT DISTRIBUTORS:

AUTOMATIC ELECTRIC SALES COMPANY, LIMITED, CHICAGO

..It Had Its Day

The horseless buggy served its purpose in the early days of mechanical transportation, but it has given way to more modern design and improved perfo mance.

So it is with telephone equipment, yet many switchboards installed in, or dating back to, the horseless buggy days are being called upon to compete with modern North "All-Relay" equipment in rendering efficient and profitable service. It can't be done. Like the first automobile, inefficient telephone equipment has had its day.

To reap the full benefits of modern development, efficiency, reliability and economy, you must install

NORTH "ALL-RELAY"

DIAL AUTOMATIC EQUIPMENT

THE NORTH ELECTRIC MFG. COMPANY Galion, Ohio, U.S.A.

Crapo
HIGH-TENSILE
LOW-RESISTANCE
TELEPHONE WIRE

Crapo HTL-85
INDIANA STEEL & WIRE CO
MUNCIE INDIANA U.S.A.

For Long Spans

Crapo HTL-135
INDIANA STEEL & WIRE CO
MUNCIE INDIANA U.S.A.

For Extra Long Spans

LOWER FIRST COSTS
LESS MAINTENANCE

Construction costs are reduced to a new low level, maintenance expense is minimized, wherever *Crapo* HTL-85 and *Crapo* HTL-135 High-tensile, Low-resistance Line Wires are used. These revolutionary wires, with their superior strength, make possible rural lines with span lengths one and one-half to two and one-half times greater than were practical heretofore.

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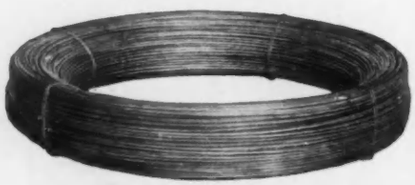

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